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SOVIET ECONOMY IN THE 1980's: PROBLEMS AND PROSPECTS

Part 1

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LETTERS OF TRANSMITTAL

DECEMBER 22, 1982.

To the Members of the Joint Economic Committee:

I am transmitting for the use of the Joint Economic Committee, Congress, and the interested public a compilation of papers assessing economic developments in the Soviet Union entitled "Soviet Economy in the 1980's: Problems and Prospects, Part 1." This volume analyzes Soviet economic reform efforts, the industrial sector, energy, technology, and the military burden, among other topics.

We are grateful to the Congressional Research Service of the Library of Congress for making available John P. Hardt, who helped plan the scope of the research and coordinated and edited the papers. An Advisory Committee, composed of Daniel L. Bond, Paul K. Cook, Douglas B. Diamond, Murray Feshbach, Richard F. Kaufman, David M. Schoonover, and Lawrence H. Theriot, helped in the planning for this and the companion volume, to whom we express our appreciation. Dr. Hardt was assisted by Donna Gold of the CRS staff. The project was supervised for the Joint Economic Committee by Richard F. Kaufman.

The views contained in this study are not necessarily those of the Joint Economic Committee or of its individual members.

Sincerely,

HENRY S. REUSS,
Chairman, Joint Economic Committee.

DECEMBER 18, 1982.

Hon. HENRY S. REUSS,
Chairman, Joint Economic Committee,
Congress of the United States, Washington, D.C.

DEAR MR. CHAIRMAN: Transmitted herewith is a volume of studies on the Soviet economy entitled "Soviet Economy in the 1980's: Problems and Prospects, Part 1." The studies were written by specialists who were invited to contribute and who are all experts on the economy of the Soviet Union. The authors come from universities, research organizations, and agencies of the Federal Government.

The views expressed in the papers are those of the individual authors and do not necessarily represent the views of their organizations or of the members of the Joint Economic Committee.

Sincerely,

RICHARD F. KAUFMAN,
Assistant Director, Joint Economic Committee.

CONTENTS

SOVIET ECONOMY IN THE 1980's: PROBLEMS AND PROSPECTS, Part 1

Page

Letters of Transmittal III
Highlights: Problems and Prospects—John P. Hardt VII

I. POLICY PERSPECTIVES

Overview—Martin J. Kohn 1
The Political Setting—Paul K. Cook 10
Soviet Perceptions of Economic Prospects—M. Elizabeth Denton 30
Administrative Reform and Soviet Politics—Paul Cocks 46
Soviet Economic "Reform" Decrees: More Steps on the Treadmill—Gertrude E. Schroeder 65
Soviet Policy Towards Technological Change Since 1975—Martin C. Spechler 89
Soviet Policy Options in Trade Relations With Eastern Europe—Michael Marrese and Jan Vaňous 102
Interaction of Politics and Trade: Soviet-Western Interaction—Marshall I. Goldman 117
Soviet Investment Policy in the 11th Five-Year Plan—Robert Leggett 129

II. PLAN AND PERFORMANCE

Overview—Kate S. Tomlinson 147
Possible Causes of the Deterioration of Soviet Productivity Growth in the Period 1976-80—Herbert S. Levine 153
Sources of Low Productivity in Soviet Capital Investment—Stanley H. Cohn 169
Sluggish Soviet Steel Industry Holds Down Economic Growth—Central Intelligence Agency 195
Transport in Trouble—Holland Hunter and Deborah A. Kaple 216
The Role of Territorial Production Complexes in Soviet Economic Policy—David S. Kamerling 242
A Note on Soviet Inflation—Gregory Grossman 267

III. MILITARY ALLOCATIONS AND BURDEN

Overview—Abraham S. Becker 287
The Soviet Machinery Balance and Military Durables in SOVMOD—Daniel L. Bond and Herbert S. Levine 296
The Soviet Policy Favoring Arms Over Investment Since 1975—Myron Rush 319
The Dynamic Burden of Soviet Defense Spending—Gregory G. Hildebrandt 331

IV. ENERGY SUPPLIES AND TRADE

Overview—Ronnie Goldberg 351
Soviet Energy Consumption: Structure and Future Prospects—Laurie Kurtzweg and Albina Tretyakova 355
Near-Term Prospects for Soviet Natural Gas Industry, and the Implications for East-West Trade—Ed. A. Hewett 391
CMEA Oil Acquisition Policy in the Middle East and the Gulf: The Search for Economic and Political Strategies—Jonathan P. Stern 414
Soviet Energy Policy—Thane Gustafson 431
Soviet Policy in the Development of Nuclear Power in Eastern Europe—Lesley J. Fox 457

V. SCIENCE AND TECHNOLOGY

Page
Overview—Donna L. Gold 509
Western Technology Transfer to the Soviet Union: Problems of Assimilation and Impact on Soviet Imports—George D. Holliday 514
Soviet Patents and Inventors' Certificates—John A. Martens 531
Integration of CEMA Science and Technology—Louvan E. Nolting 541

HIGHLIGHTS: PROBLEMS AND PROSPECTS

By John P. Hardt

Problems and prospects for the Soviet economy in the decade of the 1980s are of pivotal concern for Western and Soviet decisionmakers. The economy that grew at a rate of 5.2 percent per annum in Brezhnev's first Five-Year Plan (1966–70), the Soviet Union's Eighth, grew at 2.7 percent in his last, the Tenth (1976–80). Moreover, the last several years from 1979 through 1982, GNP growth has been below the Five-Year Plan growth trends, hitting a low point of 0.8 percent growth in 1979.[1] The trend downward in economic performance has been compounded by poor agricultural performance, resulting from an adverse weather cycle, and a global recession restricting Soviet foreign trade earnings. Those long- and short-term problems may lead to further economic decline—even crises.

The Brezhnev economic legacy leaves open options that may lead either to improved performance or to further decline depending upon economic fortunes and the effectiveness of policy choices taken.[2] Although the new Soviet leadership can only hope for favorable economic fortune, e.g., good weather and increasing oil prices in the future, their choice of economic policy will affect not only the day-to-day functioning of the economy but longer term prospects as well. Some of the decisive factors that will influence the outcomes of Soviet economic policy in the 1980s include:

Allocation: The management of the defense burden, the structure and efficiency of investment, and the incentives for and adequacy of consumption.

Reform: The effectiveness of short- and long-term changes in planning and management.

Regional Policy: The efficient distribution and utilization of labor, capital, and natural resources among the disparate regions of the vast USSR.

CMEA: Improvement in net economic performance through changes in the interrelationship of the Soviet economy with the economies of Eastern Europe, Vietnam, Cuba—transforming the "burden alliance or empire" to a "benefit."

Western Commerce: Growth of effective commercial interrelationships between the technologically advanced Western economies and the resource rich USSR.

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[1] See *USSR: Measures of Economic Growth and Development,* 1950–80 prepared by the Central Intelligence Agency for the Joint Economic Committee, United States Congress; Government Printing Office, December 8, 1982.

[2] C.f. "Central Intelligence Agency Briefing on the Soviet Economy," Honorable Henry Rowen, Chairman National Intelligence Council, Central Intelligence Agency before the Joint Economic Committee, Subcommittee on International Trade, Finance, and Security Economics, December 1, 1982.

Predictions are hazardous anytime, but especially so in a time of economic travail, with a new Soviet leadership, an uncertain world energy market, and reliance on weather forecasts. The papers in these two volumes written at the end of the Brezhnev era [3] offer an analytic basis for evaluating the range of likely problems and prospects faced by the Soviet economy in this decade. A careful reading of each paper is necessary to make a fully informed judgment. The overviews at the beginning of each section provide some highlights and insights. Central questions have been identified below to assist the reader in differentiating the forest from the trees.

I. WHAT IS THE RANGE OF POSSIBLE PERFORMANCE? WHAT ARE THE OPTIONS AND THE LIKELY OUTCOMES? CAN THE SOVIET LEADERSHIP COPE WITH THE PROSPECTS OF A LOW GROWTH, EVEN A NO-GROWTH, ECONOMY?

Since the peak in economic growth during the 1950s, Soviet economic performance has declined to the point where continuing growth retardation poses serious short- and long-term problems. Do the Soviet leaders and planners perceive their economic growth problem as critical? Are they prepared to act effectively in order to bring about the necessary changes to counter further growth deterioration? The answers given by most authors are "yes and no." The Soviets do seem to assess their growth problems with reasonable pragmatism, but attempted past solutions appear to have continuously fallen short of the needs, particularly during the rule of Leonid Brezhnev. The overriding question may now be: Will the current leaders be forced to pay the political price for a changed economic policy promising improved performance? That price includes:

Less priority in economic resource allocations to the institutionally strong defense sector;

Significant changes in the political-economic system affecting the dominant role of the Communist Party;

Increased allocations to resource and labor endowed regions outside the Great Russian dominated, developed European areas;

A reduction in resource allocations to the Council of Mutual Economic Assistance (CMEA),[4] that might result in reduced control by Moscow and political instability in Eastern Europe; and

Increased interdependence with Western economies that would enhance vulnerability to global economic conditions and Western political influence.

There are some who would argue that anything the Soviet leaders might do that would be economically significant in improving performance, say to a 3 to 4 percent annual GNP growth, would be politically unacceptable within the USSR, and that anything they might do that was politically acceptable would be economically insignificant.

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[3] The papers in these two volumes were written prior to the death of Leonid Brezhnev.

[4] The Council for Mutual Economic Assistance is an economic alliance consisting of the U.S.S.R., Bulgaria, Czechoslovakia, German Democratic Republic, Poland, Hungary, Romania, Mongolia, Cuba, and Vietnam.

Moreover, it is argued that the institutionally strong power holders in the military, police (KGB), and Party apparatuses have no motivation or reason to support changes within a system that has been successful in meeting their needs. Past economic policy and performance provided resources for increased military power as the basis of a successful foreign policy and internal control as the basis of system maintenance. A further implicit argument in favor of continuity is that while adverse external forces such as poor weather, negative foreign market conditions, and political instability in important adjoining regions (Poland, Afghanistan, etc.) might foster crises within the troubled Soviet economy, they would not precipitate a political collapse of the system.

Most authors in these volumes might agree that some changes that could improve the quality and quantity of Soviet economic performance are possible; however, few writers find evidence of such changes—especially in the short run.[5]

II. CAN THE SOVIET ECONOMY MAKE THE TRANSITION FROM EXTENSIVE TO INTENSIVE DEVELOPMENT? CAN STALINIST-TYPE GROWTH BE SUPPLANTED BY A MORE EFFICIENT, MODERN ECONOMY IN THE USSR?

The "command economy" of the Stalinist era mobilized the necessary resources for the establishment of a powerful industrial base with a strong defense sector by diverting resources from the nonpriority sectors or "residual claimants"—housing, transportation, consumer good sectors, and agriculture. Efficiency in the use of labor, capital, and management was secondary to overall growth in Stalin's plan for a forced industrial expansion. Now, however, the current economic strategy of intensive development—improved labor productivity and lower capital-output ratios—redresses the low priority assigned to the neglected sectors of the past, such as transportation and agriculture, making them competitive with the traditionally preferred sectors of metallurgy, machine building, energy, and defense support. Furthermore, factor productivity and quality of output have replaced quantity as the vital ingredients of economic development.

In spite of constant exhortations by the leadership to shift away from the economically inefficient extensive growth formula to the more efficient intensive strategy, the reality has been a continued downward trend in capital efficiency and labor productivity, and only modest improvement in output quality. Why does the deterioration of factor productivity seem to be so powerful and persistent in the Soviet system?

Imbalances throughout the economy and specific problems in key economic sectors have been recognized impediments to the general transition to intensive development. The imbalances in the production processes have tended to frustrate any effort to improve productivity and relieve critical bottlenecks. In addition, the Soviets have been unable to efficiently and effectively absorb new, advanced technologies, either domestic or foreign, into their industrial processes.

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[5] C.f. Henry Rowen, *Ibid.*

The Soviet planners argue that bottlenecks in the heavy industries sectors such as iron and steel, and in rail transportation, can and must be relieved. The establishment of new pipelines, electric power transmission, and an expanded transportation infrastructure, they maintain, will provide a broader base for correcting the interregional pattern of locational imbalances. Furthermore, the effective use of technology via the Scientific and Technological Revolution (STR) has been heralded by Soviets for years as an answer to productivity needs.

Many authors herein, in contrast to Soviet planners, tend to be extremely skeptical of the prospects of improvement in the efficiency of capital, labor, and material utilization. The downward trend in factor productivity derives from a pattern of formidable problems plaguing the Soviet economy. The transition from the Stalinist, command economic strategy of growth in basic industrial and defense support industries to widespread economic growth through a more comprehensive modern economic process seems to have had limited success under Brezhnev, and according to most authors promises to be a daunting problem for Brezhnev's successors.

III. CAN SOVIET LEADERSHIP MANAGE THEIR DEFENSE BURDEN? ARE GROWTH, BUTTER, AND GUNS TRADEOFFS?

With an economy little more than half as large as that of the United States, the Soviet Union has been able to devote as much or more in resources to expanding its military power. There is no doubt that objectively Soviet defense outlays are a heavy burden. But burden is a subjective or political judgment. Soviet leaders have presumably been satisfied that the benefits in moving toward military equivalence with the US and NATO, and in some sense even beyond, and in providing the military basis for global power have been within a range of acceptable cost or bearable burden. Now in the 1980s the costs may escalate and the deterioration in overall economic performance may be drastic enough to require a reappraisal—even a defense debate. That point has not been reached in the view of most of the authors herein. A reduction in the growth of defense would not necessarily provide a certain, or some would argue a likely, dividend in significantly higher growth in national income or in more consumer goods.

On the other hand, continued expansion of Soviet defense capability is likely to have an adverse effect on the availability of investment capital and skilled labor as well as on growth in consumption. Aggravated labor shortages and increased deficiencies in investment make further shifts to defense potentially more onerous and damaging to civilian economic performance. To the extent that increased incentives for improved consumption and increased investment are necessary for meeting economic plans, then some diminution in the rate of increase in defense outlays may be necessary to provide planned, needed, economic and political benefits. In the final analysis the guns, growth, or butter question will be determined by how the Soviet decisionmakers set their priorities and what their cost-benefit assessments tell them. Although some new factors influencing the incremental burden of defense and a new leadership in power appear to support a reduction in the growth of defense allocations, past patterns and presumed, continued Soviet perceptions of the need for and utility of expanding their military buildup reinforce the skepticism about change expressed by most authors herein.

IV. Will Energy Supplies Be Sufficient To Provide for Planned Growth in the Domestic Economy, Meet the Needs of CMEA, Earn Necessary Hard Currency, and Underpin Soviet Global Energy Diplomacy?

With the most abundant natural resources of any of the industrial economies in terms of proven and probable energy reserves, the Soviet Union still finds energy sufficiency a potential Achilles heel. The Western approach to energy sufficiency—decreasing demand while increasing supply—has been slow to develop in the USSR. Moreover, Soviet adoption of programs for effectively managing energy demand and for conservation appears doubtful to date.

Slow domestic growth and a moderate winter in 1982–83 have masked the long-term urgency of improved energy performance. Energy supply will not only be a factor affecting Soviet domestic growth, but also a restraining resource affecting CMEA economic performance, a limiting influence on hard currency earnings for financing Western trade, and an important ingredient in Third World diplomacy.

Adequate growth in the overall energy supply will continue to be the central issue. Because of Soviet plans for holding the line in output of oil and coal, expansion in natural gas, nuclear, and hydro output will be integral to attaining energy sufficiency.

Timing and volume are of the essence throughout the Soviet energy balance. A key question is whether gas output can expand at the time and in the quantity necessary to fill voids in energy supply created by a period of declining oil output. On this central question of the Soviet ability to maintain energy sufficiency, Western assessments, including those of the authors herein, are still divided.

V. Can Technological Change—The Engines of Recent Western Economic Miracles—Become the Dynamic Force in Soviet Economic Development?

Western economic "miracles" drew from each other. This sharing of science and trade in technology made possible the dramatic improvements in systems and products that generated the increased productivity of the post World War II period. Stalinist economic development—the most extensive period of Soviet economic development to date—did not emphasize the role of science and high technology, particularly foreign science and technology. Even in the post-Stalin period, the Soviet STR, despite its utilization of Western technology, has not resulted in technological advancement in the Soviet civilian economy comparable with that accomplished in the West. Why has the Soviet system had so much difficulty in transferring, absorbing, assimilating, and benefitting from advanced technology either developed at home or abroad? Is that slowness to adapt to technological potentials a technical or management problem? Why has the Soviet Union been slow to import technology and effectively utilize it? Is that a systemic problem, one of hard currency shortage, or a resource allocation, priority question? Certainly levels of inputs and priorities can change, but can the Soviet system? The STR record to date provides a basis for the considerable skepticism expressed by the authors herein about future technological dynamism in the USSR.

VI. CAN THE SOVIET UNION IMPROVE THE QUALITY AND QUANTITY OF FOOD AND AGRICULTURAL PRODUCTS BY CHANGE IN THEIR AGRICULTURAL SYSTEM AND BY IMPORTS SUFFICIENT TO PROVIDE MATERIAL INCENTIVES AND CITIZEN SATISFACTION?

Improved consumption through more and better food production is certainly high on the economic agenda of the Soviet leadership. Importation of Western grain and agricultural technology appear to be accepted as at least short-term solutions. Agricultural investment and personal peasant incomes are relatively high by past standards. The natural resource base in terms of land availability and climate pose difficulties but not of the sort that are not managed better elsewhere in the world. Regardless of variations in weather conditions, wheat especially should be in adequate supply from the effective use of Soviet acreage. What is the problem? The assessment of long-term problems seems to be largely directed against the collectivized agriculture system; the short-term shortfalls against the weather.

The most recent formula for improving agriculture, the Food Program, calls for organizational adjustments within the existing system—more effective organization at the center and in the locality. Will these changes be adequate to insure significantly improved performance? Will the weather improve against the norms of the past with a reasonable expectation of several good to excellent harvest years? Serious analysts have reservations on a positive answer to either of those questions. Some suggest that the weather of the past 20 years, thought by some to be normal, was indeed good and the decade ahead will be one of generally poor weather conditions, not conducive to improved agricultural performance. Others also negatively note that substantial investment and continued modest changes in the collectivized agricultural system still leave performance far short of the levels Soviet leaders seem to view as necessary. If the collectivized system of agriculture is politically necessary and sufficient economic improvement is not possible within that system, then the Soviet prospects for adequate food output and improved performance in agriculture are indeed dim. Poor weather and limited hard currency availability for paying for imports of grain and other products could significantly worsen the situation in any given year.

VII. CAN LABOR PRODUCTIVITY BE INCREASED SUFFICIENTLY TO STIMULATE GROWTH, OR ARE PROBLEMS OF SUPPLY, INCENTIVES, AND QUALITY OF LIFE TOO INSURMOUNTABLE TO BE CORRECTED?

Labor is unique as a factor of production. Workers and peasants may add economic burdens or benefits. Meaningful human reward is an end product as well as an incentive for increased output. What makes people as both consumers and producers especially important in the current stage of Soviet development? The answer includes unusual labor shortages, extremely uneven regional demographic growth, and the increasingly onerous problem of quality of labor force.

In 1983 the Soviet Union is experiencing the "second echo of World War II", that is a sharp drop in draft age cohorts and a large number of older workers and peasants joining the ranks of pensioners. As overall demographic trends have changed, population growth has become concentrated in the Southern, non-Slavic republics outside of both the areas of European capital and infrastructure development and Siberian natural resource potential. With an absolute population decrease in the traditional European regions, this shortage makes increased labor productivity not only important but imperative. The dispersion of the labor force makes regional labor mobility an especially vexing problem.

Problems in the health of the population and in terms of the quality of life tend to compound the adverse labor and demographic trends. Measures of Soviet health such as morbidity, birth rate, and infant mortality are surprisingly low when viewed in relation to what they were and to other countries at comparable stages of economic development. In particular, the statistics showing declining life expectancy for Great Russian males and rising infant mortality are puzzling and must disturb Soviet officials.

Some of the health problems may be responsive to future improvements in the allocation of resources. But spending more money alone will not resolve the problems; social and political factors have raised the broader question of "the quality of life in Soviet society" in the minds of many Western observers. Resolution of the central human factor problems—ranging from labor shortage to the quality of life—in the 1980s seems to be unlikely. Accommodation to human factor problems is apparently a central issue in the views of the authors herein.

VIII. Can the Soviet Union Afford and Efficiently Use the Imports They Plan?

As expanded trade and credit relations are sought with Western developed economies as necessary for meeting short-term production bottlenecks and gaining access to advanced technology in the 1980s, the Soviet ability to afford Western imports has become especially important. Restricted world markets, soft energy prices, and massive grain import requirements are serious limiting factors.

Moreover, the Soviets appear to be caught between needing Western imports and fearing Western interdependence. Troubled Soviet leaders seem to fear that interdependence with the West might lead to political vulnerabilities. Western use of trade for foreign policy purposes has increased, especially with rising U.S. concerns over the Soviet arms buildup and Soviet misbehavior abroad, e.g., Southern Africa, Southeast Asia, Afghanistan, and Poland.

As the United States and its Western allies reconsider the benefits of Eastern trade in economic and political terms, the Soviet

Union must also reappraise the net advantages of Western trade. Will Western, particularly U.S., trade with the USSR be an effective political and economic tool in U.S. foreign policy? Will the Soviet Union use trade effectively to its own advantage and hence the Western disadvantage? Or is it more likely that Western trade will be developed in a generally apolitical context of mutual economic interdependence? No easy answers to these questions are available in Moscow, Washington, or other Western capitals.

Resumed Economic Growth or Collapse?

Economic growth is a problem high on Moscow's agenda for the 1980s. Economic collapse—a series of negative growth periods with a loss of political control by the Party—seems beyond the ranges of reasonable probability in most Western, professional assessments. Crises—economic problems serious enough to trigger basic changes in priority allocations and systemic characteristics—are possible, although not generally predicted by the authors herein. Most foresee a general continuation of past priorities and systemic characteristics.

Resistance to change based on past successful performance and from the entrenched Party and institutional bureaucracies is generally expected to continue. Change is not ruled out, however. Changes in present resource allocations and reforms of the present planning and management systems are possible and might show significant results. The external factors of weather and the world market might improve. The conventional wisdom as expressed and documentated in these volumes is still toward continuity with the past. Continuity suggests the likelihood of continued declining performance and aggravated economic problems—outcomes the current Soviet leadership appears to consider unacceptable. Therefore, on balance, the views expressed herein tend toward the judgment that although economic improvement from policy change or good fortune is possible and may be expressed as a priority of the new leadership, it is no better than an even odds bet and probably worse.

Despite the modest expectations of most authors in these volumes, as well as others, the possibility of change in economic policy resulting in significantly improved economic performance in the Soviet Union should not be discounted. The initial emphasis of Yuri Andropov on his troubled economic indicators not only suggests concern about the seriousness of the problems but also expectation that policy changes within his power may improve both qualitative and quantitative performance. Specifically he has taken the following steps:

Allocation: By indicating a policy of increased emphasis on investment and continued, if not enhanced, priority to consumption, the prospects for a squeeze on resource allocation to defense have been raised.

Reform: By centralizing economic planning and management in the Party and other central organizations, emphasizing professionalism on all levels of planning and management, selectively making personnel changes, and demanding increased discipline throughout the economy, the question of the short-term significance of changes within the system has been raised anew, but with an apparent greater seriousness than in the Brezhnev era.

Regional Policy: By stressing the need for completing the national infrastructure of transmission, transportation, and other means of resource mobility, the retarding effects of resource dispersion may be reversed.

CMEA: By reducing the economic "subsidy" to Eastern Europe through restricted deliveries of oil and gas at below world market prices and requiring increased deliveries of machinery and consumers goods—the bilateral trade deficit—the perceived net outflow of resources from the USSR to other parts of CMEA may be reduced.

Western Commercial: By greater reliance under Yuri Andropov on "world experience", especially through technology transfer from Western Europe and Japan, the Soviet Union may—if hard currency earnings permit—stimulate domestic economic performance.

I. POLICY PERSPECTIVES

OVERVIEW

By Martin J. Kohn*

SUMMARY OF MAIN THEMES

The eight papers in the Policy Perspectives section are in broad agreement on those issues they address in common. Six of the papers focus on internal aspects of the Soviet economy. The following key points emerge.

1. The Soviet economy has entered a period of malaise marked by a pronounced slowing of overall growth.
2. The Soviet leadership has for a long time been aware of mounting obstacles to economic growth. Like Western analysts, it knows that the old growth strategy of lavish infusions of labor, capital and material inputs is no longer feasible and must be replaced by one that relies primarily on technological progress and more efficient use of resources for any given level of technology. In short, "extensive growth" must give way to "intensive growth."
3. The leadership is confident that the slowdown, if not immediately reversible, can be kept sufficiently moderate through ameliorative action that does not drastically change the system of highly centralized economic planning and management.
4. In fact, however, the measures that the regime has adopted, in great profusion, in recent years to raise productivity and thus at least partially offset the impact of exogenous growth-retarding forces are likely to prove ineffectual. Indeed, some—particularly those that increase the layers and dimensions of centralized economic administration—could worsen economic performance by intensifying the workload, and the rivalries and confusion, within the economic bureaucracy.
5. The likelihood that economic results that fall short of current official expectations will soon produce more radical corrective action—i.e., measures that significantly loosen central control and move the economy in a more market-oriented direction—seems low. The current leadership's commitment and attachment to the present system seems firmly entrenched. Furthermore, it is apparently counting on the population to continue its habitual passive response to adverse economic developments and on the abatement in the 1990s of many of the unfavorable economic circumstances of the 1980s. Nor are the successors to the present aged leadership likely to quickly institute sweeping economic reform. The views of Brezhnev's immediate successors are likely to be similar to his.

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*Office of Soviet Analysis, Central Intelligence Agency.

And even leaders drawn from a new generation, and perhaps more likely to look favorably on substantive systemic alterations, will probably have to bide their time until their power is consolidated.

6. The regime's apparent confidence in the effectiveness of the measures it has taken to raise productivity is reflected in the output goals for the 11th Five-Year Plan (1981-85). Though the Plan calls for lower rates of increase in production than previous plans did, the targets are unrealistically high, aggravating tautness in an already overstrained, bottleneck-ridden economy.

7. Given the combination of tightening exogenous constraints and essentially non-adaptive responses by the leadership, the outlook for the 1980s is one of continued slow economic growth.

8. A sudden and pronounced decline in GNP is not likely, however. Despite its deeply ingrained inefficiencies and irrationalities, the economy will grind on, enmeshed in inefficiency but avoiding collapse.

The principal themes in the two papers dealing with Soviet economic relations abroad are these:

1. Soviet subsidies and other assistance to Eastern Europe will almost certainly continue, but the unpromising character of the USSR's own economic prospects suggests that it will make stiffer demands on Eastern Europe for greater economic benefits in return.

2. Western efforts to exert economic leverage on the USSR run the risk of boomeranging, in part because of damage to economic interests in the countries that apply the pressure.

SOVIET PERCEPTIONS OF THEIR PROBLEMS

The Soviet economy is beset by problems and constraints, both exogenous and of the USSR's own making, that have produced a sharp slowdown in economic growth in recent years. According to Western measures, gross national product (GNP), which increased at an average annual rate of 3.7 percent in 1971-78, averaged only 1.3 percent a year in 1979-81. Poor performance in the farm sector, reflecting a succession of poor harvests, played an important part in the decline in real growth. But the slowdown was pervasive. Growth in industrial production, for example, has steadily declined, reaching a post World War II low of 2 percent in 1981.

Official Soviet statistics, though they consistently show higher rates of growth than do Western calculations, likewise record a sizable drop in growth rates. Soviet "national income"—essentially, GNP minus services—rose by 4.8 percent a year in 1971-78, but by only 3.1 percent in 1979-81.[1] The corresponding figures for officially measured industrial production are 6.5 percent and 3.6 percent, respectively.

As M. Elizabeth Denton's paper makes clear, the Soviet leadership has not been blind to the USSR's economic problems. It has been aware for at least a decade that a growth strategy dependent on pouring large quantities of labor, capital and material inputs into the economy was becoming increasingly infeasible. The leaders have likewise been cognizant of the formidable difficulties they face in making the transition to an intensive growth strategy based on greater efficiency and higher productivity. It is indeed striking how closely Soviet and Western diagnoses of Soviet economic problems parallel one another.

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[1] For a discussion of why growth in Soviet aggregates such as national income and industrial production is overstated, see forthcoming JEC volumes that deal with Soviet aggregate economic activity through application of Western concepts and methodologies.

As Denton's analysis shows, Soviet leaders explicitly recognized, as early as the beginning of the 1970s, that circumstances essentially beyond Soviet control were developing to the USSR's disadvantage. The leaders were publicly candid about such unfavorable developments as reduced growth in the labor force, which commenced in the late 1970s, and the rapid drying up of easily accessbile and extractable natural resources. In particular, publicly expressed concern over the growing tightness of energy supplies mounted during the 1970s.

Nor, as Denton demonstrates, have Soviet leaders been laggard in identifying systemic malfunctions that impede Soviet efforts to achieve the rises in productivity that alone can hold the decline in economic growth to moderate dimensions. Obstacles to improved efficiency they cite with particular frequency, according to Denton, include the inordinate amounts of time required to complete investment projects, lack of appropriate incentives and managerial arrangements to promote introduction of new technology and encourage conservation of resources, and chronic consumer goods shortages that impair motivation to work. Soviet leaders also openly acknowledge the existence of especially weak sectors. Agriculture is a prime example, as is transportation. Top Soviet officials, furthermore, have not glossed over the disappointing results of so-called reform measures, nor have they minimized the likelihood that technological progress will be slow.

In short, as Denton observes, Soviet and Western assessments of the USSR's economy are in many respects virtually indistinguishable from one another. In both the West and the USSR, the economy is preceived as having lost the momentum that, depsite all its shortcomings, it was once able to generate. Western analysts and Soviet leaders alike see little or no evidence so far of successful solutions to the problems that have brought about sharply declining economic growth in the USSR.

Western observers and Soviet officialdom generally part company, however, in their perceptions of (1) what is required to instill efficiency and vigor in the Soviet economy and (2) the USSR's prospects for lifting the economy out of its current doldrums.

Most Western students of the Soviet economy hold that substantially improved economic performance requires major systemic changes that significantly decentralize the administration of the economy and introduce critical elements of market economies, such as prices that more accurately reflect relative scarcities. In the Soviet Union, on the other hand, the policital leadership's faith in the present system apparently remains firm.[2] Despite persistent failure of essentially piecemeal ameliorative measures, the regime, as Denton shows, still seems convinced that "tinkering can make the system work." What amount to marginal changes in the system coupled with bunching of investment in key problem areas are being counted on to ward off stagnation now and restore more rapid growth in the future.

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[2] Outside the top circles of power, such faith seems considerably less widespread. Many Soviet economists, for example, evidently share the Western view that the system needs major revamping.

Why so sanguine a view of the system on the part of the present leadership? According to Denton, part of the explanation is that "Moscow's aged leaders have a vested interest in and close indentification with the system as it is." Official optimism may also reflect expectations of an easing of labor and energy shortages in the 1990s that will reduce current pressures on the system. In the meantime, the regime appears to be relying on acceptance of stagnating living standards by the populace to avoid the need for radical changes in the economy.

INADEQUACY OF SOVIET MEASURES

The actions taken by the regime in the last several years to improve economic performance—as described in the papers by Gertrude Schroeder, Martin Spechler and Paul Cocks—have in no sense transformed the system. In fact, the "tinkering"—which has proceeded at an energetic, sometimes frenetic pace—has on balance accentuated the characteristics associated with the Soviet centrally planned, command economy. The effects of the steps taken by the regime range from minimal to harmful.

The measures adopted by the regime since 1979 are comprehensively described and analyzed in the Schroeder paper. Her main points, and many of the key points in the Spechler and Cocks papers, are briefly summarized here.

The Soviet campaign to make the economic system work better is currently based on a sweeping economic "reform" program contained in a decree of July 1979 and an "avalanche" of implementing measures in its train. The decree sought greater stability in economic plans and toward this end gave emphasis to five-year rather than annual plans. To promote efficiency it laid the groundwork for changes in prices to make them more accurately reflect costs, replacement of gross output by net output as the principal success indicator, introduction of more self-financing by enterprises, and creation of incentive schemes better designed to advance the objective of higher productivity and higher quality of output.

Many elements of the reform package seem more likely to defeat rather than advance the goals of greater efficiency. The program enhanced centralization of planning and administration, increasing centralized control over allocation of resources through administrative fiat. It made plan stability a desideratum even though the Soviet economy urgently needs greater flexibility to respond to unforeseen economic and technological developments. Many of the measures are enormously complicated and thus seem certain to increase work, confusion and conflict within the bureaucracy. One example is the vast array of incentive schemes—labeled by Schroeder as "of Byzantine complexity." Another is the superimposition on the ministerial system of new economic programs generally to be run by special commissions and directed at solving specific economic problems in functional or geographic spheres of economic activity that go beyond the jurisdiction of a single ministry or other established economic administrative body.

Some of the reform measures are seemingly sensible but are likely to make little difference in practice. For instance, making net output (or value added) the priority target for enterprises could reduce the waste of materials that was actually encouraged by the primacy of the gross output target. However, gross output has not been eliminated as a success indicator and still influences such variables as the size of enterprise bonuses. Moreover, the chief effect of elevating net output to prime goal could be to supplant one set of abuses with another. In trying to maximize net output, enterprises, while they might reduce profligate use of materials, could make excessive use of labor—in a period of manpower shortages. Consequently, changing the ranking of success indicators does not rid the system of one of its major flaws, namely, the encouragement of perverse behavior by economic managers. The latter, in pursuit of plan fulfillment, often are impelled to act in ways that are economicially irrational and at odds with the ends the success indicators are supposed to serve.

Introduction of new wholesale prices and broader application of self-financing by enterprises and ministries also seem a step in the direction of good economic sense. Neither of these changes is expected to have much effect, however. Prices are still administratively determined and still do not accurately mirror relative scarcities. Thus, to the extent that they do influence resource allocation, the new prices will not foster greater efficiency. Their role in allotting resources remains, at best, marginal, though, with central directives continuing to be decisive. Because output goals imposed from above retain priority, it is likewise dubious that making ministries and enterprises more dependent on self-generated funds and bank loans instead of budget grants will make them behave more frugally.

In sum, there is consensus among the authors who address the reform issue that the regime's quest for greater economic efficiency and a system more receptive to technological progress has been fundamentally futile and has in some instances reinforced the worst features of the current system. As Spechler points out, the efforts of the last few years reflect a continuation of the retreat from the few limited decentralizing steps of the mid- and late 1960s that, among other things, sought to give enterprises somewhat more autonomy and more power to determine the quantity and quality of the inputs they bought. As Schroeder says, the regime's measures have not attached the three basic ills of the Soviet system: "(1) the lack of a reliable (efficient) guide to choice; (2) the attenuated influence of consumers on producers and (3) the absence of the discipline of competition among suppliers."

LACK OF REALISM IN 11TH FIVE-YEAR PLAN

A noteworthy feature of the current Soviet economic scene is the unrealistic nature of the current five-year plan goals. Perhaps reflecting the regime's apparently staunch optimism that the system can be made to work, many output targets for 1981–85 are far above achievable levels. The plan's lack of realism is demonstrated in Robert Leggett's paper on Soviet investment policy. Leggett matches investment targets with production goals and shows that attainment of the output targets implies a decline in incremental capital-output ratios. (The incremental capital-output ratio is the increase in capital needed to produce an additional unit of output.) These ratios have been steadily rising, with little reason to believe that the increases can be stopped let alone reversed. The leadership's hopes for a reversal are based on expectations of a surge in capital productivity to be accomplished through emphasis on re-equipping and renovating existing productive facilities—to make them more efficient and modern—and reduction in construction of new facilities. Previous efforts to implement such a strategy have failed, however, largely because of systemic flaws. Since these flaws are not likely to be remedied, failure is again probable.

LOW PROBABILITY OF RADICAL REFORM AFTER BREZHNEV

Results during the first two years of the 11th Five-Year Plan have been disappointing, with shortfalls below targets widespread and substantial. Given the mounting evidence that the current approach to improving economic performance is not working, what are the prospects that, at least when leadership passes from Brezhnev's hands, a more radical tack may be adopted? This possibility cannot be ruled out. Considerable laudatory comment about Hungary's New Economic Mechanism has appeared in the Soviet press, suggesting that some Soviet officials might welcome introduction of some of the market-type aspects of the Hungarian economic system. On balance, however—as the papers by Cocks and Paul Cook indicate—that odds against drastic overhaul of the economic system in the next several years seem high.

As Cook notes, Brezhnev is likely to be succeeded in the near term by Party leaders of the same generation, style and viewpoint. In effect, the same gereontocracy with the same distaste for radical innovation will presumably continue to rule for at least a few years more. "A true generational change is not likely until the latter part of the decade when leaders who joined the Party after Stalin's death and Khrushchev's secret speech rise to the top."

Cocks, whose views on reform prospects coincide with those of Cook, also notes that even a reform-minded leader would have to be secure in his position before undertaking major reform: "Any major reform, thus, will probably have to await the emergence in the late 1980s of a somewhat younger group of Politbureau members who might be more receptive to change and sensitive to the deficiencies of the existing system. Major reform would likely require the consolidation of the new Party leader's position as well."

SOVIET ECONOMY REMAINS VIABLE

How seriously economic conditions must deteriorate, and how restive the population must become, before pressure for radical economic reform becomes irresistible is essentially unanswerable. But Soviet economic prospects do not look so bleak that drastic systemic changes seem inevitable. As Cook emphasizes, the Soviet economy is viable. It does not face collapse or a precipitate decline in GNP. Western forecasters, though surprised by the rapidity of the economic slowdown even before labor and energy shortages have reached maximum severity, still do not expect Soviet economic growth to cease altogether. Average annual growth in GNP over the next several years might go as high as 2 percent.

The Soviet economy, despite its monstrous inefficiencies and irrationalities, grinds on. Its basic problem is loss of all dynamism that has made it exceedingly difficult for the leadership to make allocation choices among defense, consumption, and investment. In the current five-year plan, investment is scheduled to bear the brunt of the slowdown, partly because of bottlenecks in sectors crucial to construction and production of machinery, but also because of continuing priority for defense spending and heightened concern over the consumer. For the first time since five-year plans were inaugurated, investment is scheduled to grow more slowly than total output. Moderating the slowdown would probably require an increase in the share of investment in GNP above present levels, but the leadership has not yet indicated that it will make upward revisions in its investment plans.

SOVIET ECONOMIC RELATIONS ABROAD

Soviet economic troubles at home affect their economic relations abroad. The paper by Michael Marrese and Jan Vanous examines the dilemma the USSR faces in its dealings with Eastern Europe. The Soviets face hard choices in deciding (a) to what extent they should subsidize and provide other economic benefits to the six CEMA countries there, to foster stability and gain other non-economic benefits and (b) the extent to which they should cut back on such aid to ease increasingly severe strains in their own economy.

The Soviet Union has long subsidized most of the countries of Eastern Europe by trading with them on terms more favorable to them than would be the case if prevailing world market prices were applied.[3] The subsidization has stemmed from (a) underpricing of raw materials (which are the predominant Soviet export to Eastern Europe) relative to manufactured goods (the main Soviet import from Eastern Europe) in intra-CEMA trade and (b) application of world prices from lagged reference periods, which have been generally disadvantageous to the USSR because world prices of raw materials have generally risen faster than world prices of manufactured goods.

Marrese-Vanous hold that subsidization, though it has occurred partly by chance because of unpredictable changes in world prices, has been to a significant degree intentional, reflecting a Soviet policy of giving Eastern Europe special trade benefits in return for

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[3] The subsidies Marrese-Vanous calculate are an opportunity cost. The two authors are measuring the difference between (1) the trade balance the Soviets would achieve, in dollars, if the goods they traded with Eastern Europe were valued at current Western prices and (2) the actual trade balance, in transferable rubles (the unit of account used to value intra-CEMA trade transactions) converted into dollars at an exchange rate derived by the authors for the same period. Their calculations of the subsidies are highly complicated and controversial. Critics have maintained that the data on which the calculations are based are far too incomplete and inexact to permit any confidence in the resulting numbers. Their subsidy figures have also been attacked for being far too high. Nevertheless, critics have acknowledged that there is probably some element of Soviet subsidization of Eastern Europe in Soviet-Eastern European trade. The amount of the Soviet subsidy for 1960–80 calculated by Marrese-Vanous, in the paper in this volume, is $87 billion, at present value.

"military, political, ideological, and non-market economic benefits." The fact that the Soviets have retained price formulas based on lagged reference periods disadvantageous to them, according to Marrese-Vanous, shows that subsidization has been deliberate. The authors also argue that subsidies have generally varied more or less in proportion to the strategic value to the USSR of the recipient countries. This, too, the authors hold, implies intent.

Marrese-Vanous, on the basis of their projections of Soviet-East European trade and world price movements, foresee a decline in Soviet subsidization in 1982–85 from the exceptionally high levels of 1979–81 and a steady improvement in Soviet terms of trade vis-a-vis Eastern Europe in the first half of the 1980s. The Soviets will therefore be in a more favorable economic position with respect to Eastern Europe in the next few years. The problem the Soviets must solve is how to exploit this advantage without exacerbating Eastern Europe's economic difficulties and thus enhancing the probability of unrest. In the Marrese-Vanous view, the best feasible solution is for the Soviets to extend loans "for specific East European investment projects" to help bring about a restructuring of Eastern European industry that Marrese-Vanous maintain Eastern Europe urgently needs and that would, ultimately, also produce a stream of high quality Eastern European exports of manufactured goods to the USSR. Marrese-Vanous believe that the loans should be accompanied by a moderation of the present CEMA trade pricing formula to move CEMA trade prices closer to world prices. (At present, CEMA trade prices in any year are supposed to be based on average world prices for the preceding five years.) The size of the loan would equal the Soviet trade surplus plus the decline in subsidization resulting from altering the formula. Marrese-Vanous hold that subsidies have encouraged wasteful use of resources by Eastern Europe and that curtailing them will in the long run strengthen the economies in the area.

There is no indication that the Soviets are actually planning to alter the pricing formula or are considering long-term investment project loans. It does appear, though, that the Soviets will continue to run large trade surpluses with Eastern Europe.

Marshall I. Goldman's paper explores the intertwining of economic and political considerations in determining both Soviet and Western policy in East-West trade. He also examines the limits and pitfalls of economic leverage, analyzing in particular the US experience in attempting to influence Soviet behavior through exertion of economic pressure. One of his key points is that any particular instrument of leverage is likely to be only transitorily effective. According to Goldman, this is true first because the intended target may learn to adjust to or circumvent the pressures being applied and second because leverage can have ill effects on the country or countries exerting it, leading to appeals for elimination or dilution of these pressures. Goldman says that the US has now all but ruled out grain embargoes as a medium of leverage because of opposition to them by US farmers.

Goldman also argues that leverage—when it does work—must be followed up by delivery of the rewards that were at least implicitly promised in return for the desired behavior. Otherwise, subsequent attempts at leverage will be seriously handicapped. According to

Goldman, the US erred in not granting MFN and access to US Export-Import Bank credits to the Soviet Union when Jewish emigration from the USSR surged in the latter half of the 1970s.

At the moment, the issue of economic leverage, at least in the form of a concerted Western effort, seems academic. Among Western countries, only the US has pushed hard for restrictive economic and financial measures against the USSR. Differing views on the appropriate political approach to the USSR and doubts about the effectiveness of economic and financial pressures partly explain the reluctance of the Allies to support the US. High unemployment and slack capacity have intensified their resistance to actions that might cost jobs or eliminate profitable business.

THE POLITICAL SETTING

By Paul K. Cook*

CONTENTS

		Page
I.	Overview	10
II.	Political dynamics	11
III.	The party system	16
IV.	Economic organization and operations	24
V.	The future	27

I. OVERVIEW

Economic decision-making in the Soviet Union is concentrated in the hands of the Kremlin gerontocracy. These same men are also responsible for the preservation of the Party's supremacy in the Soviet system of rule, national security abroad and internal order at home, and the state of Soviet society generally. In the Kremlin, economics is politics, and, to an extent unbelievable in the non-communist world, politics is economics.

The political, economic, and social systems of rule are largely those inherited from Stalin. Exceptions include, relatively speaking, the replacement of terror by intimidation, ideology by nationalism, revolutionary elan by bureaucratic regulations. But the Soviet state continues to prosper, most notably in strategic military prowess, despite its ever more visible and varied problems, especially in agricultural production.

Since Stalin's death, the Soviets have moved from a position of military inferiority (by their own account) to one of "parity" (by our account). And they have done so despite the fact that their economic base is only slightly more than half of ours—thus their armaments burden is twice that which we have borne.

The ability of the Soviet Union to sustain its massive military establishment, much less compete in any potential arms race, while meeting the rising if disappointed expectations of its citizenry depends in large measure on the state of its economy. Allegations to the contrary, it is a viable economy. For example, industrial output has risen from less than 30 percent of that of the US in 1950 to more than 80 percent in 1980.[1] It grew so rapidly that Khrushchev predicted and distinguished Western economists speculated, when-not-if the Soviet economy was going to catch up and surpass ours. It has not, nor is it likely to in the foreseeable future; but today the

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[1] Narodnoye khozyayistvo SSR v 1980, (Moscow, 1981), p. 59.

Soviet Union is the world's largest producer of iron ore, steel, cement, and oil.

Recently, however, clearly declining rates of growth, coupled with three—now four—harvest shortfalls, have focused attention on Soviet economic weaknesses. Industrial labor productivity, according to Soviet statistics, still amounts to about 55 percent of that of the US; and agricultural labor productivity, to 20–25 percent.[2] Increments to the labor force, a traditional source of economic growth, are declining sharply. The composition of the labor force is also changing as the proportion of urban Slavs declines and that of rural Muslims grows. Energy supplies are becoming increasingly costly to exploit, though oil production continues at record, though perhaps below-plan, levels, and natural gas output booms.

There is no denying the fact that the Soviet Union suffers from systemic weaknesses. As the end of the Brezhnev era approaches, there is still no publicly known orderly transition process; the economy is sputtering, though above the line rather than below as is the case in the recession-prone West; Soviet hegemony has been rejected by China and a growing number of non-ruling Communist parties; the Soviet style of rule is under direct challenge in Eastern Europe; and even the vaunted Soviet military establishment is at best holding its own in Afghanistan, while Soviet armaments in the hands of Syrians have been humiliated by the US-equipped Israelis.

On balance, however, the Soviet Union is a military superpower, has the world's second largest economy—and may not be as vulnerable as some argue. The glass is at least half full, not half empty. And even if the Russian bear suffers from arteriosclerosis and is a mite malnourished—at least 20 major Soviet cities now ration food—it is still powerful enough to hurt with its jaws and claws.

II. Political Dynamics

Changes in Soviet policies are not likely in the foreseeable future no matter who wields the gavel in Kremlin conclaves. The realities of the prime determinant of policy, the Soviet domestic scene, do not lend themselves to quick, much less painless, solutions. Neither will the external environment become more amenable just because other hands wield the gavel. The world scene is basically a marginal determinant in Soviet policymaking, but it can be the crucial last straw. Certainly international ambience can affect the perceptions of the Soviet leadership and thus color its judgments.

The world environment.—Brezhnev and Company have learned the hard way that the world is not as simple as the maxims of Marxism-Leninism teach. A third of mankind lives in countries ruled by Communist parties. Once all paid obeisance to Moscow. Today, the Chinese attack the Soviets as social imperalists seeking to impose hegemony over the world. In Eastern Europe, the Poles are under martial law, ruled by a military junta with the local Communist party in shambles. They and other former "satellites," despite more than a generation of Communist rule, seem as nationalist as ever. Popular anti-Sovietism bubbles just under the surface—and boils over intermittently, e.g., Berlin in 1953, Budapest in 1956, Prague in 1968, and throughout Poland in 1981–82.

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[2] Ibid, p. 60.

The costs of Communist empire were unforeseen and are now rising. In addition to their own defense establishment, the Soviets are now faced with increased subsidies to the Poles as they teeter on bankruptcy, and to the financially troubled Romanians, and even to the reform-minded Hungarians. North Korea has already defaulted and the Vietnamese appetites must seem insatiable. And Soviet Finance Minister Garbuzov must be thankful that there are no more Cubas.

Soviet relations with non-ruling Communist parties are also less than harmonious. The largest, the Italian, denounced the Soviet-inspired crackdown in Poland, was denounced in turn, but has remained critical as Moscow has moderated its attack in the aftermath of Suslov's death in February 1982. Even the outgoing leader of the Communist Party of Finland has called a spade a spade by criticizing Soviet intervention in its affairs.[3]

It would be a mistake, however, to conclude that the scene as viewed from the Kremlin is one of unmitigated gloom. The perspective of the gerontarchs is different from ours. They were grown men when the Soviet Union was the only Communist state; stood virtually alone against a Hitler coalition victorious on the Continent and occupying most of European Russia; knew first-hand the loss of 20 million Soviets during World War II, including 13 million civilians, many of whom died of starvation; and saw their fellow countrymen living in earthen dugouts after the war.

Politburo member and Foreign Minister Gromyko's proud claim at the 24th Party Congress in 1971 that the Soviet Union had become so powerful that no problem of any significance anywhere in the world could be solved without taking into account Soviet interests [4] was exaggerated. But it contained more truth than fiction. From Namibia to the highlands of Eritrea, to the Middle East, Kampuchea, and the Caribbean, Moscow is a factor. Moscow's military forces are deployed in Asia, Africa, and Cuba, and its navy sails the seven seas.

The largest Soviet military contingent is deployed against NATO and is backed up by a strategic nuclear force second to none. The Soviet Union has been present in Central Europe for three decades. And even Washington admits that the Soviet Union is a superpower, on a par with the United States.

How to maintain if not enhance that parity in the face of a rearming West led by the United States, and an economy that is slowing down, is perhaps the most important and intractable problem faced by the Kremlin other than the impending transfer of political power. The resource allocation conundrum is discussed elsewhere in this compendium. But it seems clear from Soviet political history that Moscow is both willing and able to invest additional sums to placate its not wholly unjustified paranoia. The costs have been horrendous: 6 million deaths due to famine caused by collectivization; [5] 15 million in Stalin's purges; [6] 20 million during World

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[3] "Suomen Kuralekti", May 21, 1982.

[4] Pravda, Apr. 4, 1971.

[5] Dana Dalrymple, "Soviet Famine of 1932–34," Soviet Studies (January 1964), pp 250–84.

[6] Robert Conquest, "The Great Terror" (London, 1968) p. 533.

War II; and the suffering and degradation under the Gulag shroud immortalized by Solzhenitsyn.

While the present Soviet leaders may not agree that all this was necessary for the State to survive, it is reasonable to assume that they are united in the belief that these sacrifices shall not have been in vain.

The domestic scene: the succession.—A host of domestic problems face the aged and increasingly frail leadership. Agriculture with its submarginal grain harvests, especially of feed grains, has created a high carbohydrate, low-protein diet short on meat, milk, and dairy products. Rising consumer expectations in food, clothing, and housing, caused by greater awareness of Western, even East European, living standards, are outstripping production increases. The virus of nationalisms among the disparate peoples of the Soviet Union is causing increasing social—and perhaps in the future, political—strains.[7]

The biggest problem, one fraught with danger for the Soviet system, is the political succession. The deaths of long-time Premier Kosygin, the epitome of the government-managerial class, and Party Secretary Suslov, his counterpart among the ideologues, created major gaps in leadership ranks. These gaps, however, were filled by reshuffling responsibilities among the Party elders. The first succession following Breshnev's departure may result in a similar solution.

Odds are that when Brezhnev departs the scene he will do so with his boots on. Odds also are that the 25 men—no women—who were selected to the Central Committee Politburo and Secretariat will continue as the leadership core. They average 69 years of age. Brezhnev's successor, and most likely his successor's successor, will come from their ranks.

The Soviet system of rule is structured to preclude anyone from outside these extant leadership ranks from taking supreme power. Though one can never rule out the possibility, the proverbial man on horseback does not seem a likely prospect. The Soviet military, like its Tsarist predecessor, does not have a Bonapartist tradition. Rather, to the extent it has involved itself in high politics, it has limited itself to supporting the civilian contender who has been most favorably disposed toward military concerns.[8]

In the near term, Brezhnev's successor almost certainly will be one of the other 12 full members of the Politburo (see Chart I).[9] He should already have national level responsibilities, which eliminates regional party bosses Kunayev, Romanov and Shcherbitskiy.

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[7] For additional commentary, see Paul K. Cook, "The Soviet Conglomerate," U.S. Department of State Special Report No. 67, March 1980. The push and pull of Jewish, German, and Armenian "nationalists," plus a host of other factors, has resulted in the emigration of more than 350,000 since the early 1970s. The rate of emigration of all groups, however, has slowed to a trickle since 1980.

[8] For example, well within the political memory of the current leadership, Soviet World War II hero, and Minister of Defense Marshal Zhukov twice had the Central Committee surrounded by his troops: in 1953 when secret police chief Beria was arrested, and in 1957 when the anti-Party group led by Molotov, Malenkov, and Kaganovich was ousted. Zhukov intervened only to support Khrushchev, who rewarded him with promotions to candidate and then full member of the Politburo. Zhukov was purged late in 1957 when he reportedly tried to subordinate the Party apparatus within the military to himself, not to the Central Committee as tradition would have had it.

[9] All charts and tables were prepared by my colleague, Maurice M. Cook.

Others can be excluded because of age, e.g., Pelshe at 83, or too narrow a specialization, such as Gromyko at 73 with foreign affairs or Ustinov at 73 with defense; new party secretary for agriculture Gorbachev seems too young at 51, as well as too new to Moscow—2 years.

At present there would appear to be four prime candidates for Brezhnev's mantle as General Secretary.[10]

Alphabetically they are:

—Yuriy V. Andropov, 68, a 9-year Politburo veteran, the longtime chairman of the KGB who relinquished that post in May 1982 when he returned to the Party Secretariat. He is now a conventional-wisdom favorite to succeed Brezhnev and allegedly has assumed Suslov's portfolio as chief ideologist and overseer of foreign affairs. This line of reasoning ignores the fact that while Suslov may have been a king-maker, he was never the king, only the conscience of the revolution.[11]

—Konstantin U. Chernenko, 70, a 4-year Politburo member, is apparently favored by Brezhnev, his patron of many years, to succeed him. In the aftermath of Suslov's death, Chernenko may have generated opposition by moving too quickly to assume power. At present he appears to oversee the key cadres and police within the Secretariat.

—Viktor V. Grishin, 67, an 11-year veteran of the Politburo, head of the largest single Party organization—Moscow's—for the last 15 years and before that the chief of the 100-million plus Soviet trade union organization. But unlike the others, he is not in the Secretariat and thus lacks national level responsibilities. And,

—Andrei P. Kirilenko, 75, 10 years on the Politburo, a long time associate of Brezhnev who frequently seconded him until this year when Kirilenko reportedly fell ill and/or lost favor.

These are the candidates derived from the least squares school of Kremlinology.

Signs of traditional maneuvering have reappeared, especially since Suslov's death. Chernenko and Kirilenko alternated in the No. 2 slot on Lenin's mausoleum during Suslov's funeral ceremony; one of Grishin's papers cropped Kirilenko out of another mausoleum lineup; and Andropov may have been behind the reports of scandals, perhaps involving Brezhenv's children, allegedly to diminish his ability to designate Chernenko as heir.

But what is important is not just the man. (Moreover, our prediction record in recent years in this regard is not good; witness the dismissal of the "faceless bureaucrat" Khrushchev in 1953 and the 1964 predictions that the "lightweight" Brezhnev was not serious enough to hold down the No. 1 slot for long.) More significant is how these individuals view the world and how they perceive the Soviet role in it. Unfortunately, there is very little to go on to reach solid judgments in these areas. Though some Kremlinologists will quibble, only rough generalizations appear valid.

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[10] His other major positions, President and Chairman of the Defense Council, need not, and probably will not, be assumed by one man, at least at the outset.

[11] For a short but detailed sketch of Andropov, see Charles Fenyevesi, The Washington Post, May 30, 1982.

Andropov is allegedly the most intelligent and sophisticated of the four candidates. Some commentators even allege he may be a Soviet-style "closet liberal"—reformer is more correct. But most specialists opine that, should he succeed, he could be a progressive in foreign policy but would pursue tightened internal discipline.

Chernenko has not displayed great intellectual prowess. He has published articles on a wide variety of subjects which avidly second Brezhnev's policies. In addition to Brezhnev's patronage, perhaps Chernenko's greatest asset is that he does not appear to threaten his fellow elders. But while he may be a moderate by Soviet standards, he is not by ours. Last fall, with Poland clearly in mind, he called for greater responsiveness by leaders to the led, then went on to threaten to purge those leaders who were not.[12]

Grishin is a dark horse. He has been around a long time and knows the Moscow ropes. Reportedly a bright man, he seems cast in the faceless-bureaucrat mold publicly, much in the manner of former Moscow Party Secretary Khrushchev.

Kirilenko, who has acted for Brezhnev frequently when the latter has been ill or out of town, is clearly the most experienced of the lot. His reported recent serious illness, plus his age (he is 3 months older than Brezhnev), may have removed him from the competiton.

If the speculation above has merit, then Brezhnev's immediate successor is not likely to rule for long; another succession will probably take place later this decade. As to the identity of the next successor, the Kremlinological crystal ball becomes even more opaque. But he, too, is probably already a member of either the Politburo and/or Secretariat, and almost certainly a member of the Central Committee.

Some commentators have opined that if meaningful change does not occur during the short-lived immediate successor regime, it will in the next round. There is a mood of "frustration bordering on despair and outrage" in the next generation,[13] one that may well be on the periphery of the present power structure. But political realities are such that Brezhnev's successor's successor most surely will come from the same mold.

The infusion of fresh blood is likely to be closely controlled by the surviving elders. Conformity is the key to promotion in the Soviet system far more, say, than in ours, and those that rise to the top will be well honed in the value system of their predecessors. And, because the odds favor continuation of a collective style of leadership as the successors sort out their new relationships, the possibility of radical change early on is low. Change will occur, perhaps even a modified Hungarian style economic reform or retrenchment abroad, but it will be carefully introduced.

An institutional factor that will limit the influence these men or others will be able to bring to bear will be the nature of the decision-making process itself as it has evolved under Brezhnev. In retrospect, one of his greatest contributions to Soviet history may turn out to be his use of the collective. His reported willingness to listen to argumentation, patiently staff out problem areas, and involve others in the decision-making process—together with his refusal to use terror and intimidation, at least against his ostensible peers—enabled him to rise, prosper, and remain in office despite his decreasing effectiveness.

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[12] K. V. Chernenko, Kommunist, No. 13, September 1981.

[13] See Dimitry K. Simes, "How to Affect Moscow," New York Times, July 4, 1982. cf Jerry Hough, Washington Post, May 7, 1982.

Because the aspirants for his mantle have been part of this process for years, they bear responsibility both for policies formulated and for policies implemented. The tendency of their style of leadership to slow, least-common-denominator type decisions has not doubt been frustrating to the activist-oriented. But it has been orderly and safe and, odds are, is likely to prevail at least at the outset of the post-Brezhnev era.

Decisionmaking. Decisions in Party organizations are reached *in camera*; voting does occur, but consensus is the more usual form. What few votes are published are virtually all unanimous. Two exceptions stand out; both date from the anti-Party group scandal of 1957. Khruschev refused to bow to the "arithmetic majority" in the Politburo on the grounds that the Central Committee, not the Politburo, had elected him First Secretary. Some portion of the Central Committee met [14] and sustained him. During the subsequent voting to purge the anti-Khrushchevites, Old Bolshevik Molotov refused to vote for his own expulsion.

This is not to say, however, that meaningful if not vitriolic arguments do not occur. A host of Western Kremlinological studies by Michel Tatu, Robert Conquest, and others [15] testify to the contrary. And Khrushchev himself in the two volumes of excerpted taped memories describes quite a few.

The Brezhnev era, to be sure, has produced fewer examples of policy disputes; but as it winds down, internal discipline appears to be eroding. In the economic sphere, the most recent example has been the dispute over the utility of forming rayon (county) agricultural production organizations (RAPOs) to better coordinate the plethora of line organizations present, each of which has a "piece of the action." Proposed by Brezhnev at the May 25 CPSU Central Committee Plenum in mid-June, in 1982 the concept was warmly endorsed by Chernenko, Vice President Kuznetsov, and Georgian Party boss Shevardnadze—but was only briefly noted by agricultural Party secretary Gorbachev, ignored by RSFSR Premier Solomentsev, and dismissed as inapplicable by the Azerbaydzhan Party leader, Aliyev.[16]

III. THE PARTY SYSTEM

The Communist Party of the Soviet Union (CPSU) continues to monopolize political life. Brezhnev, as General Secretary, sets the agenda and chairs when able the weekly session of the policy-setting Politburo (see Chart I) which sits on top of the Party pyramid. Since 1977 he has also formally chaired the Presidium of the Supreme Soviet (see Chart IIA), hence his title of "President." Finally, he is Chairman of the Defense Council, hence his military rank of Marshal of the Soviet Union.

---

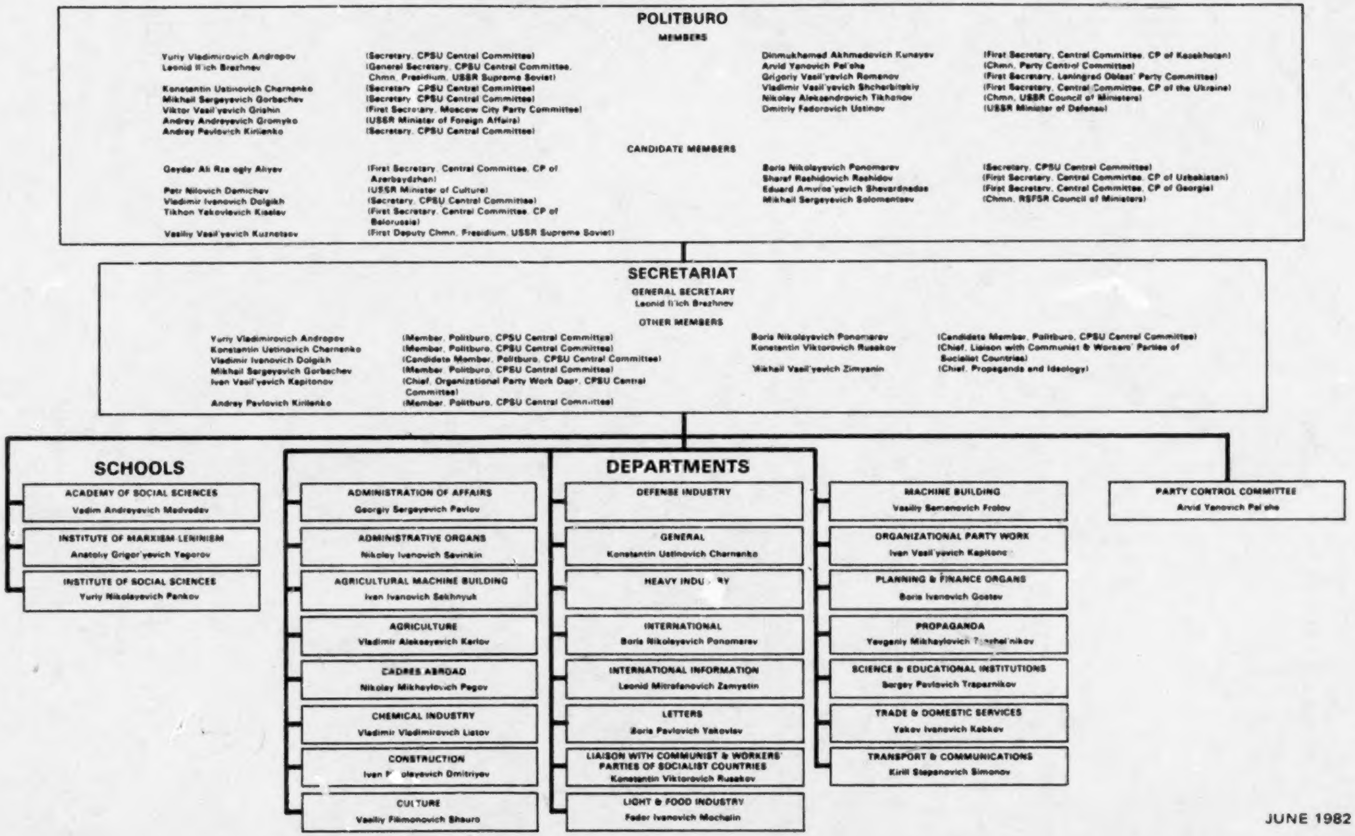
[14] We do not know what counts as a quorum in Soviet practice. In any event, time was too short to bring in many of the 50-odd percent of its members who work outside of Moscow.

[15] Michel Tatu, "Power in the Kremlin, from Khruschev to Kosygin" (New York, 1969) passim; Robert Conquest, "Power and Policy in the USSR: The Study of Soviet Dynasties" (New York, 1961) passim; Strobe Talbot, ed., "Khruschev Remembers" (New York, 1970) passim; and Talbot, "Khruschev Remembers: The Last Testament" (Boston, 1974), passim.

[16] Cf of the Soviet central press, May 26–June 18.

CHART I — CPSU CENTRAL COMMITTEE

Executive and Administrative Apparatus



POLITBURO

MEMBERS

Yuriy Vladimirovich Andropov	(Secretary, CPSU Central Committee)
Leonid Il'ich Brezhnev	(General Secretary, CPSU Central Committee, Chmn. Presidium, USSR Supreme Soviet)
Konstantin Ustinovich Chernenko	(Secretary, CPSU Central Committee)
Mikhail Sergeyevich Gorbachev	(Secretary, CPSU Central Committee)
Viktor Vasil'yevich Grishin	(First Secretary, Moscow City Party Committee)
Andrey Andreyevich Gromyko	(USSR Minister of Foreign Affairs)
Andrey Pavlovich Kirilenko	(Secretary, CPSU Central Committee)
Dinmukhamed Akhmedovich Kunayev	(First Secretary, Central Committee, CP of Kazakhstan)
Arvid Yanovich Pel'she	(Chmn. Party Control Committee)
Grigoriy Vasil'yevich Romanov	(First Secretary, Leningrad Oblast' Party Committee)
Vladimir Vasil'yevich Shcherbitskiy	(First Secretary, Central Committee, CP of the Ukraine)
Nikolay Aleksandrovich Tikhonov	(Chmn. USSR Council of Ministers)
Dmitriy Fedorovich Ustinov	(USSR Minister of Defense)

CANDIDATE MEMBERS

Geydar Ali Rza ogly Aliyev	(First Secretary, Central Committee, CP of Azerbaydzhan)
Petr Nilovich Demichev	(USSR Minister of Culture)
Vladimir Ivanovich Dolgikh	(Secretary, CPSU Central Committee)
Tikhon Yakovlevich Kiselev	(First Secretary, Central Committee, CP of Belorussia)
Vasiliy Vasil'yevich Kuznetsov	(First Deputy Chmn. Presidium, USSR Supreme Soviet)
Boris Nikolayevich Ponomarev	(Secretary, CPSU Central Committee)
Sharaf Rashidovich Rashidov	(First Secretary, Central Committee, CP of Uzbekistan)
Eduard Amvros'yevich Shevardnadze	(First Secretary, Central Committee, CP of Georgia)
Mikhail Sergeyevich Solomentsev	(Chmn. RSFSR Council of Ministers)

SECRETARIAT

GENERAL SECRETARY
Leonid Il'ich Brezhnev

OTHER MEMBERS

Yuriy Vladimirovich Andropov	(Member, Politburo, CPSU Central Committee)
Konstantin Ustinovich Chernenko	(Member, Politburo, CPSU Central Committee)
Vladimir Ivanovich Dolgikh	(Candidate Member, Politburo, CPSU Central Committee)
Mikhail Sergeyevich Gorbachev	(Member, Politburo, CPSU Central Committee)
Ivan Vasil'yevich Kapitonov	(Chief, Organizational Party Work Dept, CPSU Central Committee)
Andrey Pavlovich Kirilenko	(Member, Politburo, CPSU Central Committee)
Boris Nikolayevich Ponomarev	(Candidate Member, Politburo, CPSU Central Committee)
Konstantin Viktorovich Rusakov	(Chief, Liaison with Communist & Workers' Parties of Socialist Countries)
Mikhail Vasil'yevich Zimyanin	(Chief, Propaganda and Ideology)

SCHOOLS

ACADEMY OF SOCIAL SCIENCES	Vadim Andreyevich Medvedev
INSTITUTE OF MARXISM-LENINISM	Anatoliy Grigor'yevich Yegorov
INSTITUTE OF SOCIAL SCIENCES	Yuriy Nikolayevich Pankov

DEPARTMENTS

ADMINISTRATION OF AFFAIRS	Georgiy Sergeyevich Pavlov
ADMINISTRATIVE ORGANS	Nikolay Ivanovich Savinkin
AGRICULTURAL MACHINE BUILDING	Ivan Ivanovich Sakhnyuk
AGRICULTURE	Vladimir Alekseyevich Karlov
CADRES ABROAD	Nikolay Mikhaylovich Pegov
CHEMICAL INDUSTRY	Vladimir Vladimirovich Listov
CONSTRUCTION	Ivan [illegible]olayevich Dmitriyev
CULTURE	Vasiliy Filimonovich Shauro
DEFENSE INDUSTRY	
GENERAL	Konstantin Ustinovich Chernenko
HEAVY INDUSTRY	
INTERNATIONAL	Boris Nikolayevich Ponomarev
INTERNATIONAL INFORMATION	Leonid Mitrofanovich Zamyatin
LETTERS	Boris Pavlovich Yakovlev
LIAISON WITH COMMUNIST & WORKERS' PARTIES OF SOCIALIST COUNTRIES	Konstantin Viktorovich Rusakov
LIGHT & FOOD INDUSTRY	Fedor Ivanovich Mochalin
MACHINE BUILDING	Vasiliy Semenovich Frolov
ORGANIZATIONAL PARTY WORK	Ivan Vasil'yevich Kapitonov
PLANNING & FINANCE ORGANS	Boris Ivanovich Gostev
PROPAGANDA	Yevgeniy Mikhaylovich T[illegible]shel'nikov
SCIENCE & EDUCATIONAL INSTITUTIONS	Sergey Pavlovich Trapeznikov
TRADE & DOMESTIC SERVICES	Yakov Ivanovich Kabkov
TRANSPORT & COMMUNICATIONS	Kirill Stepanovich Simonov

PARTY CONTROL COMMITTEE	Arvid Yanovich Pel'she

JUNE 1982

CHART IIA — U.S.S.R. COUNCIL OF MINISTERS: MINISTRIES

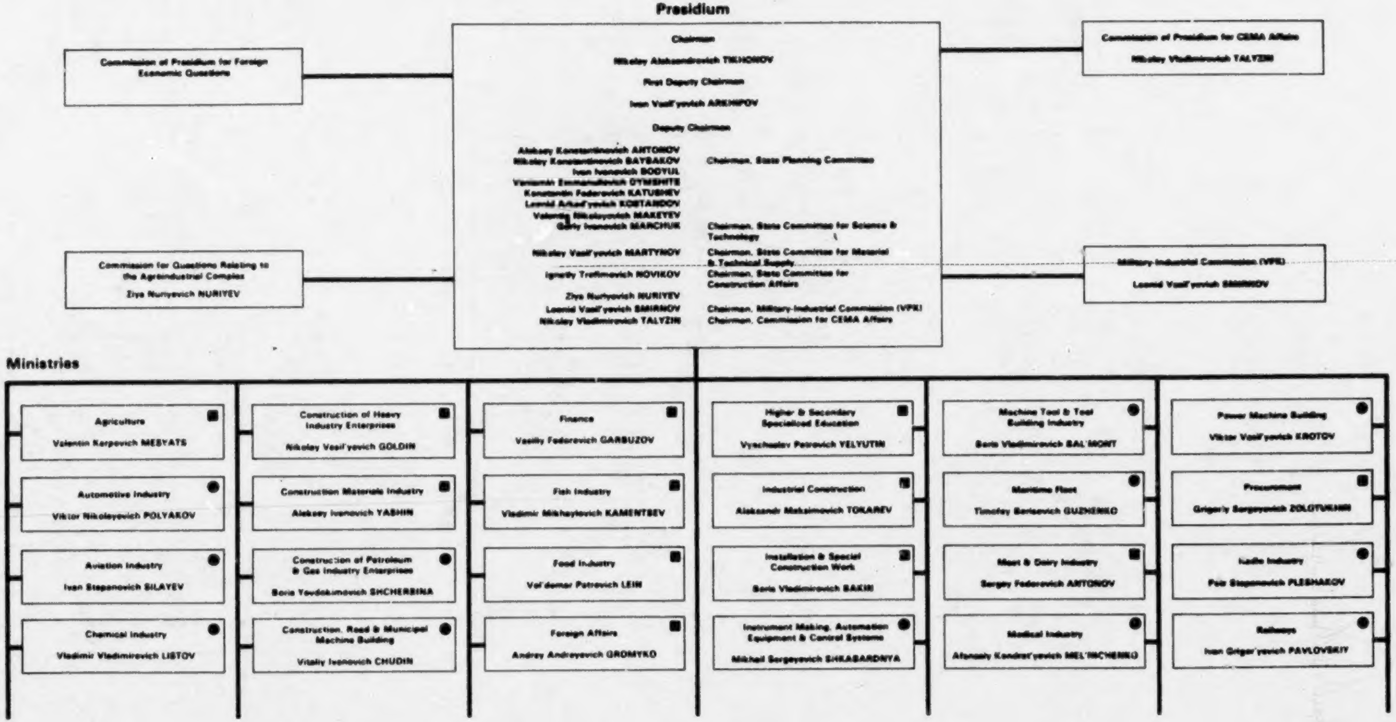

Commission of Presidium for Foreign Economic Questions
Commission for Questions Relating to the Agroindustrial Complex
Ziya Nuriyevich NURIYEV
Presidium
Chairman
Nikolay Aleksandrovich TIKHONOV
First Deputy Chairman
Ivan Vasil'yevich ARKHIPOV
Deputy Chairmen
Aleksey Konstantinovich ANTONOV
Nikolay Konstantinovich BAYBAKOV — Chairman, State Planning Committee
Ivan Ivanovich BODYUL
Veniamin Emmanuilovich DYMSHITS
Konstantin Fedorovich KATUSHEV
Leonid Arkad'yevich KOSTANDOV
Valentin Nikolayevich MAKEYEV
Guriy Ivanovich MARCHUK — Chairman, State Committee for Science & Technology
Nikolay Vasil'yevich MARTYNOV — Chairman, State Committee for Material & Technical Supply
Ignatiy Trofimovich NOVIKOV — Chairman, State Committee for Construction Affairs
Ziya Nuriyevich NURIYEV
Leonid Vasil'yevich SMIRNOV — Chairman, Military-Industrial Commission (VPK)
Nikolay Vladimirovich TALYZIN — Chairman, Commission for CEMA Affairs
Commission of Presidium for CEMA Affairs
Nikolay Vladimirovich TALYZIN
Military-Industrial Commission (VPK)
Leonid Vasil'yevich SMIRNOV
Ministries
■ Agriculture — Valentin Karpovich MESYATS
● Automotive Industry — Viktor Nikolayevich POLYAKOV
● Aviation Industry — Ivan Stepanovich SILAYEV
● Chemical Industry — Vladimir Vladimirovich LISTOV
■ Construction of Heavy Industry Enterprises — Nikolay Vasil'yevich GOLDIN
■ Construction Materials Industry — Aleksey Ivanovich YASHIN
● Construction of Petroleum & Gas Industry Enterprises — Boris Yevdokimovich SHCHERBINA
● Construction, Road & Municipal Machine Building — Vitaliy Ivanovich CHUDIN
■ Finance — Vasiliy Fedorovich GARBUZOV
■ Fish Industry — Vladimir Mikhaylovich KAMENTSEV
■ Food Industry — Vol'demar Petrovich LEIN
■ Foreign Affairs — Andrey Andreyevich GROMYKO
■ Higher & Secondary Specialized Education — Vyacheslav Petrovich YELYUTIN
■ Industrial Construction — Aleksandr Maksimovich TOKAREV
■ Installation & Special Construction Work — Boris Vladimirovich BAKIN
● Instrument Making, Automation Equipment & Control Systems — Mikhail Sergeyevich SHKABARDNYA
● Machine Tool & Tool Building Industry — Boris Vladimirovich BAL'MONT
● Maritime Fleet — Timofey Borisovich GUZHENKO
■ Meat & Dairy Industry — Sergey Fedorovich ANTONOV
● Medical Industry — Afanasiy Kondrat'yevich MEL'NICHENKO
● Power Machine Building — Viktor Vasil'yevich KROTOV
■ Procurement — Grigoriy Sergeyevich ZOLOTUKHIN
● Radio Industry — Petr Stepanovich PLESHAKOV
● Railways — Ivan Grigor'yevich PAVLOVSKIY

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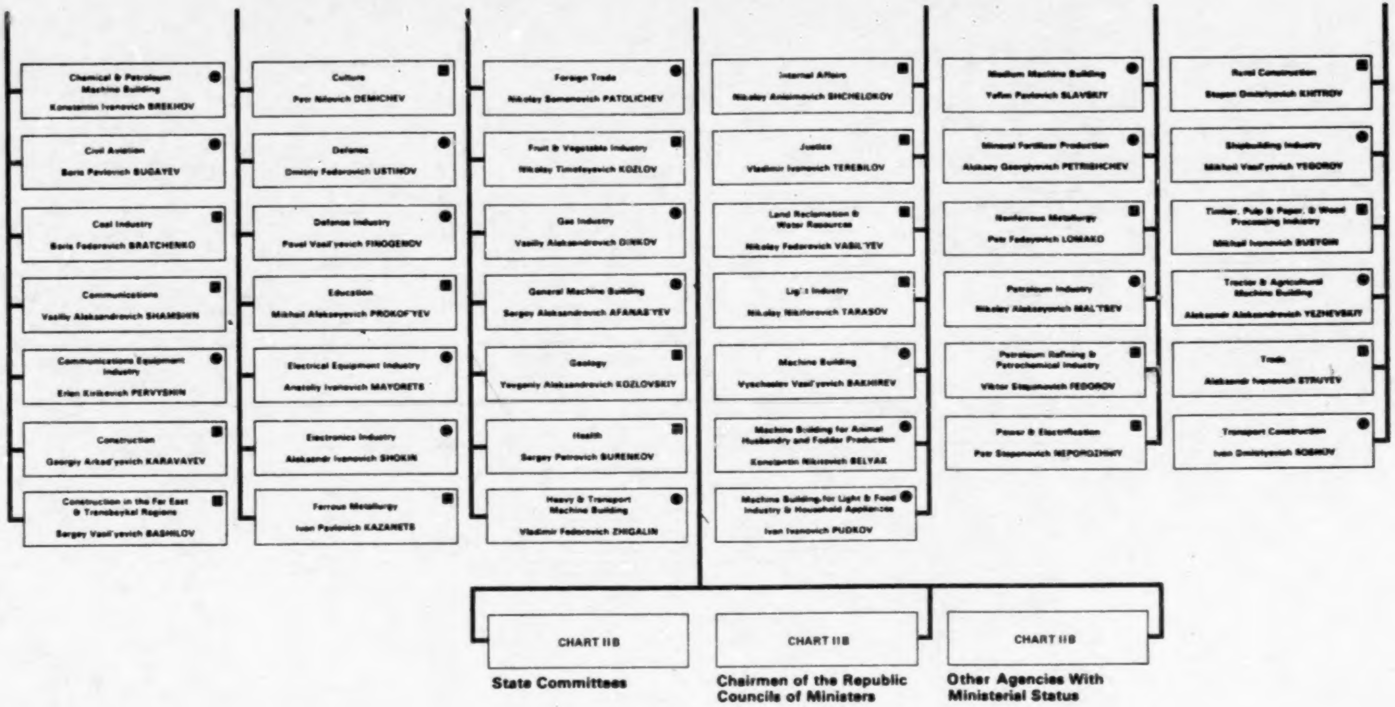
CHART IIA—U.S.S.R. COUNCIL OF MINISTERS: MINISTRIES—Con.


Chemical & Petroleum Machine Building ●
Konstantin Ivanovich BREKHOV
Civil Aviation ●
Boris Pavlovich BUGAYEV
Coal Industry ■
Boris Fedorovich BRATCHENKO
Communications ■
Vasiliy Aleksandrovich SHAMSHIN
Communications Equipment Industry ●
Erlen Kirikovich PERVYSHIN
Construction ■
Georgiy Arkad'yevich KARAVAYEV
Construction in the Far East & Transbaykal Regions ■
Sergey Vasil'yevich BASHILOV
Culture ■
Petr Nilovich DEMICHEV
Defense ●
Dmitriy Fedorovich USTINOV
Defense Industry ●
Pavel Vasil'yevich FINOGENOV
Education ■
Mikhail Alekseyevich PROKOF'YEV
Electrical Equipment Industry ●
Anatoliy Ivanovich MAYORETS
Electronics Industry ●
Aleksandr Ivanovich SHOKIN
Ferrous Metallurgy ■
Ivan Pavlovich KAZANETS
Foreign Trade ●
Nikolay Semenovich PATOLICHEV
Fruit & Vegetable Industry ■
Nikolay Timofeyevich KOZLOV
Gas Industry ●
Vasiliy Aleksandrovich DINKOV
General Machine Building ●
Sergey Aleksandrovich AFANAS'YEV
Geology ■
Yevgeniy Aleksandrovich KOZLOVSKIY
Health ■
Sergey Petrovich BURENKOV
Heavy & Transport Machine Building ●
Vladimir Fedorovich ZHIGALIN
Internal Affairs ■
Nikolay Anisimovich SHCHELOKOV
Justice ■
Vladimir Ivanovich TEREBILOV
Land Reclamation & Water Resources ■
Nikolay Fedorovich VASIL'YEV
Light Industry ■
Nikolay Nikiforovich TARASOV
Machine Building ●
Vyacheslav Vasil'yevich BAKHIREV
Machine Building for Animal Husbandry and Fodder Production ●
Konstantin Nikitovich BELYAK
Machine Building for Light & Food Industry & Household Appliances ●
Ivan Ivanovich PUDKOV
Medium Machine Building ●
Yefim Pavlovich SLAVSKIY
Mineral Fertilizer Production ●
Aleksey Georgiyevich PETRISHCHEV
Nonferrous Metallurgy ■
Petr Fadeyevich LOMAKO
Petroleum Industry ●
Nikolay Alekseyevich MAL'TSEV
Petroleum Refining & Petrochemical Industry ■
Viktor Stepanovich FEDOROV
Power & Electrification ■
Petr Stepanovich NEPOROZHNIY
Rural Construction ■
Stepan Dmitriyevich KHITROV
Shipbuilding Industry ●
Mikhail Vasil'yevich YEGOROV
Timber, Pulp & Paper, & Wood Processing Industry ■
Mikhail Ivanovich BUSYGIN
Tractor & Agricultural Machine Building ●
Aleksandr Aleksandrovich YEZHEVSKIY
Trade ■
Aleksandr Ivanovich STRUYEV
Transport Construction ●
Ivan Dmitriyevich SOSNOV
CHART IIB
State Committees
CHART IIB
Chairmen of the Republic Councils of Ministers
CHART IIB
Other Agencies With Ministerial Status

■ Union Republic ● All Union

Union Republic organizations operate locally through corresponding organizations on the republic level. All union organizations have no such regional counterparts

JUNE 1982

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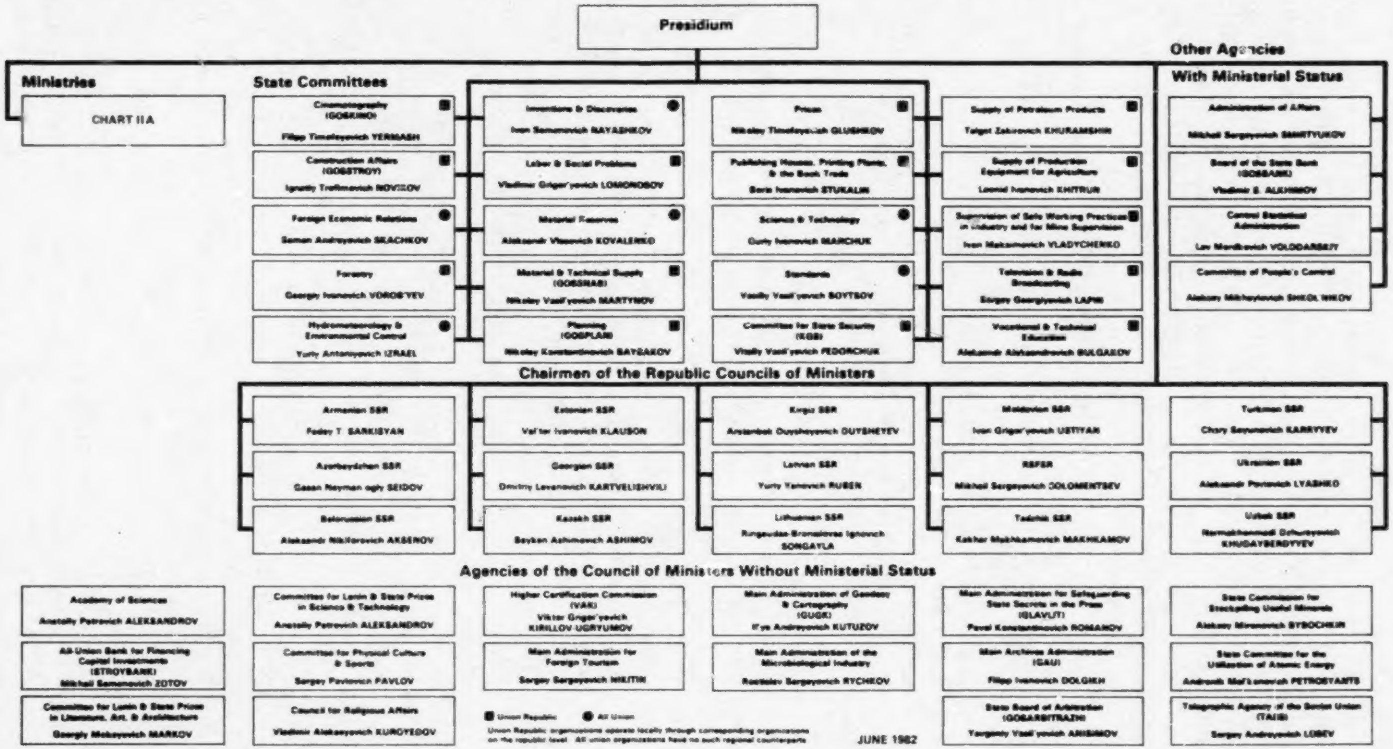
CHART IIB — U.S.S.R. COUNCIL OF MINISTERS: STATE COMMITTEES AND OTHER AGENCIES


Presidium
Ministries
CHART IIA
State Committees
Cinematography (GOSKINO) Filipp Timofeyevich YERMASH
Construction Affairs (GOSSTROY) Ignatiy Trofimovich NOVIKOV
Foreign Economic Relations Semen Andreyevich SKACHKOV
Forestry Georgiy Ivanovich VOROB'YEV
Hydrometeorology & Environmental Control Yuriy Antoniyevich IZRAEL
Inventions & Discoveries Ivan Semenovich NAYASHKOV
Labor & Social Problems Vladimir Grigor'yevich LOMONOSOV
Material Reserves Aleksandr Vlasovich KOVALENKO
Material & Technical Supply (GOSSNAB) Nikolay Vasil'yevich MARTYNOV
Planning (GOSPLAN) Nikolay Konstantinovich BAYBAKOV
Prices Nikolay Timofeyevich GLUSHKOV
Publishing Houses, Printing Plants, & the Book Trade Boris Ivanovich STUKALIN
Science & Technology Guriy Ivanovich MARCHUK
Standards Vasiliy Vasil'yevich BOYTSOV
Committee for State Security (KGB) Vitaliy Vasil'yevich FEDORCHUK
Supply of Petroleum Products Talgat Zakirovich KHURAMSHIN
Supply of Production Equipment for Agriculture Leonid Ivanovich KHITRUN
Supervision of Safe Working Practices in Industry and for Mine Supervision Ivan Maksimovich VLADYCHENKO
Television & Radio Broadcasting Sergey Georgiyevich LAPIN
Vocational & Technical Education Aleksandr Aleksandrovich BULGAKOV
Other Agencies
With Ministerial Status
Administration of Affairs Mikhail Sergeyevich SMIRTYUKOV
Board of the State Bank (GOSBANK) Vladimir S. ALKHIMOV
Central Statistical Administration Lev Mordkovich VOLODARSKIY
Committee of People's Control Aleksey Mikhaylovich SHKOL'NIKOV
Chairmen of the Republic Councils of Ministers
Armenian SSR Fadey T. SARKISYAN
Azerbaydzhan SSR Gasan Neyman ogly SEIDOV
Belorussian SSR Aleksandr Nikiforovich AKSENOV
Estonian SSR Val'ter Ivanovich KLAUSON
Georgian SSR Dmitriy Levanovich KARTVELISHVILI
Kazakh SSR Bayken Ashimovich ASHIMOV
Kirgiz SSR Arsanbek Duysheyevich DUYSHEYEV
Latvian SSR Yuriy Yanovich RUBEN
Lithuanian SSR Ringaudas Bronislovas Ignovich SONGAYLA
Moldavian SSR Ivan Grigor'yevich USTIYAN
RSFSR Mikhail Sergeyevich SOLOMENTSEV
Tadzhik SSR Kakhar Makhkamovich MAKHKAMOV
Turkmen SSR Chary Seyunovich KARRYYEV
Ukrainian SSR Aleksandr Pavlovich LYASHKO
Uzbek SSR Narmakhonmadi Dzhurayevich KHUDAYBERDYYEV
Agencies of the Council of Ministers Without Ministerial Status
Academy of Sciences Anatoliy Petrovich ALEKSANDROV
All-Union Bank for Financing Capital Investments (STROYBANK) Mikhail Semenovich ZOTOV
Committee for Lenin & State Prizes in Literature, Art, & Architecture Georgiy Mokeyevich MARKOV
Committee for Lenin & State Prizes in Science & Technology Anatoliy Petrovich ALEKSANDROV
Committee for Physical Culture & Sports Sergey Pavlovich PAVLOV
Council for Religious Affairs Vladimir Alekseyevich KUROYEDOV
Higher Certification Commission (VAK) Viktor Grigor'yevich KIRILLOV-UGRYUMOV
Main Administration for Foreign Tourism Sergey Sergeyevich NIKITIN
Main Administration of Geodesy & Cartography (GUGK) Il'ya Andreyevich KUTUZOV
Main Administration of the Microbiological Industry Rostislav Sergeyevich RYCHKOV
Main Administration for Safeguarding State Secrets in the Press (GLAVLIT) Pavel Konstantinovich ROMANOV
Main Archives Administration (GAU) Filipp Ivanovich DOLGIKH
State Board of Arbitration (GOSARBITRAZH) Yevgeniy Vasil'yevich ANISIMOV
State Commission for Stockpiling Useful Minerals Aleksey Mironovich SYROCHKIN
State Committee for the Utilization of Atomic Energy Andranik Mel'konovich PETROSYANTS
Telegraphic Agency of the Soviet Union (TASS) Sergey Andreyevich LOSEV
■ Union Republic
● All Union

Union Republic organizations operate locally through corresponding organizations on the republic level. All union organizations have no such regional counterparts.

JUNE 1982

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The 22-man Politburo currently has 13 full or voting members, 3 of whom are not residents of Moscow; and 9 candidates or nonvoting members, 4 of whom work outside Moscow. In addition to the 5 full and 2 candidate members of the Politburo who comprise the senior members of the Central Committee Secretariat, there are 3 other Party Secretaries, all of whom work in Moscow.

These 25 men in effect rule the USSR. In addition to Brezhnev, they include the putative rivals to be his successor, Party Secretaries Andropov, Chernenko, and Kirilenko and Moscow City Party Boss Grishin; Premier Tikhonov; and Ministers of Foreign Affairs Gromyko and of Defense Ustinov.

Since the last edition of this compendium, there have been 8 changes in this elite group:

—Premier Kosygin died in 1979 and was replaced by his first deputy, Tikhonov;

—Party Secretary (for agriculture) Gorbachev was made a full member of the Politburo in 1980;

—Belorussian First Secretary Kiselev replaced Masherov, who died, as a candidate Politburo member in 1980;

—Senior Party Secretary and conscience of the Kremlin Suslov died in February 1982;

—Andropov, a full Politburo member, gave up his KGB chairmanship and became a Party Secretary in May 1982; and

—Party Secretary (for industry) Dolgikh was made a candidate member of the Politburo, also in May 1982.

Despite these changes, the Politburo, like the Central Committee Secretariat and the Central Committee itself, have become even more of a gerontocracy (see Table I). Eight of the 13 voting Politburo members are now 70 or older. The Brezhnev-led Politburo has been dominated by men of vintage 1900-09 (Brezhnev, Gromyko, Kirilenko, Tikhonov, and Ustinov), with figures from the 1910-18 period (Andropov, Chernenko, Grishin, and Shcherbitskiy) coming up behind them. They in turn rely on men mostly in their mid-sixties who run the Party Secretariat and Council of Ministers.

Much has been written in the West—but not in the Soviet Union—about the impending "generational" change in the Soviet leadership.[17] The term is inexact for its usually connotes 33 years; what exists at most is about a decade. More importantly, the men most likely to rise to the pinnacle of power in the 1980s by and large share a common background, having joined the Party as Stalin was consolidating his power in the thirties, having survived and benefited from the purges, and having been immersed in the cauldron of World War II. Even the youngest member of the leadership, Gorbachev at 51, joined the Party while Stalin was still alive.

Compared with the Moscow-based leadership, promotion policies at the oblast level, where some 50 percent of the Central Committee membership resides, have been more flexible. Party first secretaries there average around 58 years of age, and the heads of other provincial institutions are mostly in their early 50s. As the aged leaders at the center depart, some of these younger officials will likely be summoned to high office in Moscow (some are already Central Committee members).

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[17] Jerry Hough, op. cit.

TABLE I.—AGE COMPOSITION OF CPSU LEADERSHIP

[In percent Jan. 1, 1982]

Age group	Politburo		Secretariat		Central committee (full)[2]
	Full	Candidate	Secretaries	Department Heads[1]	
Less than 41					
41 to 45					0.3
46 to 50	7.7				3.0
51 to 55		11.1		13.0	15.0
56 to 60	7.7	22.2	20.0	8.7	19.0
61 to 65	7.7	33.3		13.0	25.0
Over 65	76.9	33.3	80.0	52.3	25.0
Average	69.0	65.0	67.0	66.0	65.0

[1] Unknown, 13 percent.
[2] Unknown, 3 percent, according to Jerry F. Hough, "Soviet Leadership in transition" (Washington, D.C. 1980, p. 74).

Note.—Table includes multiple counting, e.g., Brezhnev is a full member of the Politburo, General Secretary of the CPSU, and a full member of the SPSU Central Committee.

Both demographically and politically, it would seem that the current leadership, including its most junior members, are of the same "generation." Only as the gerontarchs die off will new blood be brought in by the surviving elders, who until now have striven to prevent unsettling transfusions. Thus a true generational change is not likely until the latter part of the decade when leaders who joined the Party after Stalin's death and Khrushchev's "secret" speech rise to the top.

Politburo decisions are usually promulgated in the name of the Central Committee, to which the Politburo is formally subordinated. The reverse is really the case. Membership in the Central Committee is formally bestowed by Party Congresses, whose members are selected on the basis of a series of indirect elections in which the rank-and-file participate only at the first stage. Actually, membership in the Central Committee appears to go with the full-time position an individual holds. Jobs of this importance are on the *nomenklatura* or patronage list administered by the Politburo through its Secretariat staff. The leadership is thus a self-perpetuating oligarchy from which one departs by reason of age, ill health, or death or in political disgrace.

If the Politburo is the national command center, then the Party apparatus headed by the Secretariat is the central nervous system. Also chaired when possible by Brezhnev, it meets weekly to check on the execution of decisions and to draft reports for the Politburo, using its internal staff of several thousand Party officials. The Secretariat is organized as a functional duplicate of Soviet society; there are departments responsible for monitoring industry, agriculture, propaganda, education, and the armed forces and police. It is the channel through which decisions are passed through the Party system for execution and verification in every administrative-territorial division down to the basic Party organization formed in every institution, plant, or farm where there are at least three Party members. Each echelon in this system has its own smaller version of the Secretariat which controls and monitors activities within its own jurisdiction.

IV. ECONOMIC ORGANIZATION AND OPERATIONS

The basic structure and style of the Soviet economy have not changed appreciably since last examined in this series in 1979.[18] It remains essentially a command economy administered by a vast bureaucracy under tight, centralized controls. Heavy-defense industries dominate; the consumer sector is still a residual claimant to resources, though it is increasingly emphasized in regime propaganda; and agriculture remains weather-dependent and hence unreliable despite massive investments. The rate of economic growth has fallen drastically since the 1950's—but still remains respectable compared with the West. From the Kremlin's perspective, the Soviet economy continues to grow.

Soviet performance, however, has been consistently below regime expectations. Resultant disproportions have further compounded inefficiencies. Faced with much smaller net additions to the labor force, the Kremlin has placed even greater emphasis on the need to raise productivity through the introduction of new technology, much of which is to be imported. Uncertainties about Western suppliers have been particularly galling to the leadership, which is more dependent than ever before on the world division of labor.

The organization and modus operandi of the Soviet political economy are largely those inherited from Stalin. The Communist Party Politburo sets policy and oversees its execution by the Council of Ministers (see Chart IIA) through a network of several hundred thousand full-time Party officials known as the *apparat* (the apparatus). In US management terminology, there is an excessive redundancy of controls, for the entire system is based on mistrust of each official at all echelons. The basic operating philosophy is "democratic centralism," under which the most important rule is subordination of lower organs to higher ones, not of executive agencies to the legislative ones (the Soviets).

The General Secretary chairs the weekly sessions of the Politburo, where issues are discussed and decisions taken. During Brezhnev's increasingly frequent absences in recent years, his long-time associate Kirilenko is believed to have taken over, though the late Suslov is also thought to have played an important role. Since Kirilenko's reported physical and perhaps political illness in mid-winter 1981–82, Chernenko, Brezhnev's chef d' cabinet, reportedly has substituted. The Central Committee Secretariat provides the chair with both substantive and administrative staff support. The Politburo establishes the guidelines for the annual and five-year plans which are then expanded extensively by the government planning organization, Gosplan.

The Politburo reviews Gosplan drafts and recommends their acceptance "in the main" (to allow for minute exercises of democracy) to the Central Committee (to the CPSU Congress in the case of five-year plans) which, in turn, approves them. The plans are then deliberated upon by the USSR Supreme Soviet and formally promulgated, thereby giving them the force of law.

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[18] "The Soviet Economy in a Time of Change," pp. 46–49.

The Party formulates policy and monitors its execution, but it directly administers little aside from propaganda agencies and its own educational/training system. The government furnishes the muscle that gets things done. Head of government Tikhonov chairs the 114-man USSR Council of Ministers, which supervises the entire economy.

The age composition of the Soviet Government does not differ appreciably from that of the CPSU leadership (see Table 2). Almost half of the ranking members of the Presidium of the Supreme Soviet are over 65. The average age, including blue-ribboned workers and collective farmers, is 57. Ministers, however, average 72, and although sufficient data on the ages of their first deputies are lacking, internal evidence suggests the average is in the late sixties.

In sum, a demographic generational change does not appear likely if successors are promoted from within, as they have had throughout the Brezhnev era. Renewal, not rejuvenation of the leadership seems more probable.

The Council of Ministers and its Presidium determine the output of commodities, investment, military production, consumer goods, foreign trade, housing construction, prices and wages, etc.

TABLE 2.—AGE COMPOSITION OF SOVIET GOVERNMENT

[In percent, Jan. 1, 1982]

Age group	Supreme Soviet Presidium	Council of Ministers		
		Presidium	Ministers	1st Deputy Ministers [1]
Less than 41				
41 to 45	7.5			1.3
46 to 50	10.0		1.6	3.7
51 to 55	7.5	20.0	14.1	17.5
56 to 60	7.5	6.7	14.1	16.2
61 to 65	20.0	6.7	15.6	13.7
Over 65	47.5	66.6	54.6	14.9
Average age	57.0	65.0	72.0	NA

[1] Unknown, 32.5 percent.

In effect, they own and operate the productive plant and trade organizations. They also are the sole stockholder in all financial institutions.

The government functions at present in a highly centralized fashion, a reversal of Khrushchev's short-lived experiment with limited local control. There are ministries at all-union and union republic levels. The all-union ministries are located in Moscow and directly supervise production facilities throughout the country; examples are the defense and aviation industries. Union-republic ministries have a central headquarters in Moscow and subordinate ministries in the republics; the central ministry directly controls major enterprises under its jurisdiction, whereas the subordinate ministries administer the remainder. Typical union-republic ministries are agriculture and light industries of purely local significance. There are also three major supra-ministerial agencies. They are:

- —The State Planning Commission (Gosplan), which is supposed to be able to identify the needs of the economy and mobilize the resources necessary to meet these needs;
- —The State Committee for Material Technical Supply (Gossnab), which theoretically is able to ensure the availability of all requisite materials but more often than not is barely able to keep abreast of demand; and
- —The State Committee for Science and Technology (Gostekhnika), which is charged with developing and encouraging the adoption of new approaches by production agencies. It is the agency behind much of the drive to computerize the Soviet economy, develop new management techniques, and raise capital and labor productivity.

Much has been said in the Soviet Union and in the West about the need for reform of the economic organization and operations to provide stimuli/incentives and to raise factor productivity in order to revitalize growth rates. Recent outspoken calls for reform have argued that leadership decisions to economize on investments in machine-building and instrument-making have caused many of the ills plaguing the economy.[19] Academician Trapeznikov in particular insisted on effective feedback from consumers to managers.

These calls for rationality, however, have not met with universal acceptance in the political leadership. Chernenko has advocated a pro-consumer line,[20] but candidate Politburo member Pononomarev, perhaps with Poland in mind, directly attacked the concept of consumerism as a determinant of economic priorities.[21]

The Brezhnev leadership has continued the proclivity of its predecessors to tinker with the system of management. In 1965 it adopted a so-called economic reform which was mistakenly labeled in some Western publications as "creeping capitalism" because one of the success criteria was profit. Unfortunately, since the Soviet Union's centrally set pricing system chronically lags far behind actual costs, managers began to produce what was profitable for their enterprise and thereby slighted assortment. This led to disproportions on a scale comparable to that which existed when weight and value were the prime determinants.

Administrative reorganizations have been a favorite mechanism. In 1973 self-financing "production associations" were introduced in place of numerous budget-funded enterprises in industry and construction (in Western parlance, these "associations" resemble medium-sized vertical and horizontal trusts). Initial conversions were the most efficient. As less well-endowed units have been converted, gains have been more marginal. In 1976 the 25th Party Congress, nevertheless, decreed the extension of this form of management to agriculture—but little appears to have been done subsequently.

The Congress also endorsed the creation of Manhattan Project-scale organizations for undertakings involving long time periods and many agencies, such as the Baykal-Amur Main Railroad (BAM). Ranking officials, including Politburo member Romanov and new candidate Politburo member Dolgikh, have urged the creation of "complex" plans for territorial divisions, like Romanov's Leningrad-dominated Northwest Economic Region, which would encompass all economic activity in the area regardless of subordination. This approach bears a superficial resemblance to Khrushchev's *sovnarkhozy* (regional economic councils) and represents the latest-but-one attempt to balance off local versus central interests. At this writing, its fate is by no means certain.

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[19] A. Agenbegyan, Pravda, Feb. 24, 1982; and V. Trapeznikov, Pravda, May 7, 1982.
[20] "Politicheskoye samoobrazovaniye", April 1982.
[21] Pravda, June 16, 1982.

The latest attempt at economic reform was the food program decreed at the Central Committee Plenum on May 25, 1982.[22] Designed to generate sharply increased production, it frankly acknowledged shortcomings, but stuck largely to the old heavy-investment formulas accompanied by modest administrative changes, especially at the local level. At the national level yet another conglomerate of agricultural production ministries was placed under the aegis of a deputy premier. At this writing, however, this body does not include the half-dozen agricultural-industrial ministries, nor does it appear to have the power to allocate resources, alter budgets, etc., which would give it meaningful bureaucratic clout.

At the local level, the RAPOs (see page 16) seem to lack the same powers. Their closeness to the actual production scene, however, gives them greater influence. While somewhat greater freedom is granted farmers working private plots, and higher prices are to be paid for state procurements, the basic state-collective farm system with all its disincentives and inefficiencies remains intact.[23] Moreover, the massive infusion of investment will not be reflected in consumer food prices, which will continue to be heavily subsidized. And living standards will continue to lag; even if planned production goals are met, Soviet meat consumption in 1990 will still be substantially lower than 1980 levels in Eastern Europe.

These gloomy projections, however, may prove too pessimistic when the weather returns to normal, especially if the rains come on time. Odds are that average or even bumper crops will be harvested during the decade. If so, many of the shibboleths of today regarding Soviet agriculture, and by extension industries dependent upon it, will be revised dramatically—and give Soviet planners yet other reasons not to take steps to help the agricultural sector realize its potential.

V. THE FUTURE

Continuity, not meaningful change, seems likely to be the hallmark of Soviet policy over the near term. The style and pace of leadership in the post-Brezhnev period may well differ, but the substance of policy seems more likely to be constant. In this context, barring a national catastrophe, in general terms Moscow's relationship with the West will remain adversarial, and bureaucratic centralism will continue to inhibit peoples' strivings for a better life.

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[22] Pravda May 26, 1982.

[23] A measure of the relative inefficiency of the agricultural sector is the fact that 20 percent of the Soviet labor force is still in agriculture compared to only 4 percent in the U.S.

On the world scene, the Soviet Union is no longer a "have not" power. Protecting its hard-won gains will outweigh revolutionary goals in foreign policy determination. Whether that policy is primarily reactive, opportunistic, or expansionist, it is likely to be cautious.

Pursuit of targets of opportunity generated by clients, mistakes by adversaries, or events unconnected with the superpower rivalry, however, will provide ample opportunities for Kremlin miscalculation. Confrontations of sorts will occur, but Brezhnev's successors are not likely to seek them. Once Soviet prestige is committed, on the other hand, they will be most reluctant to back off.

The most immediate problem facing the Soviet leadership is the situation in Eastern Europe, where developments threaten the "Cordon Soveticus" and could spill over into the heartland itself. Pursuit of divisible detente—hostility toward the US while cultivating Western Europe—presupposes increased interaction on both sides and itself poses threats to the status quo in the Kremlin.

At home, Brezhnev and his likely successors seem determined to protect and preserve the system that has brought the Soviet Union superpower status—and given them powers, privileges, and affluence in a society officially dedicated to egalitarianism in the long run. Movement toward some form of market socialism or genuine economic reform is thus likely to be slow and hesitant. The leadership is not against change but is determined that the direction and pace of change shall be controlled.

Sino-Soviet relations will wax and wane but within narrow limits, for Beijing will never submit to what it perceives as Moscow's hegemony. And Moscow cannot accept Beijing's call for a Soviet Canossa.

The political, social, economic, military, and foreign policy questions facing the present and future leadership are interconnected and collectively pose a serious challenge to the system. Grand solutions do not appear likely for, among other reasons, the rising generation of leaders seems no more certain of answers than do Brezhnev and Company.

But the existence of these problems will not bring down the system. They have proved amenable to piecemeal tinkering, and it may well be that the future rulers will be able to stay ahead of the disaster curve.

In any event, one can only agree with the comment of Seweryn Bialer: "The consequences [of the passing of Brezhnev] will not necessarily be an improvement from the standpoint of the US, nor will they reduce the burdens and dangers of dealing with the USSR." [24]

ADDENDUM

Since preparation of Charts, I, IIA and IIB in June 1982, the following changes have taken place in the CPSU Central Committee and the USSR Council of Ministers as of July 1, 1983:

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[24] Seweryn Bialer, "Politics and Priorities in the Soviet Union: Prospects for the 1980's" (the National Council for Soviet and East European Research, Washington, D.C., 1981).

CHART I

POLITBURO

Members: Add Geydar Ali Rza ogly Aliyev (First Deputy Chmn, Presidium, Council of Ministers).

Delete Leonid Il'ich Brezhnev.

Change Yuriy Vladimirovich Andropov's responsibilities to: (General Secretary, CPSU Central Committee; Member, Presidium, USSR Supreme Soviet).

Candidate Members: Delete Geydar Ali Rza ogly Aliyev.

SECRETARIAT

Delete Leonid Il'ich Brezhnev.

Add Nikolay Ivanovich Ryzhkov.

Change Yuriy Vladimirovich Andropov's standing to that of General Secretary.

PROPAGANDA DEPARTMENT

Boris Ivanovich Stukalin replaced Yevgeniy Mikhaylovich Tyazhel'nikov.

CHARTS IIA AND IIB

PRESIDIUM

Add Geydar Ali Rza ogly Aliyev as a first deputy chairman.

Delete Konstantin Fedorovich Katushev from deputy chairmen.

RAILWAY MINISTRY

Nikolay Semenovich Konarev replaced Ivan Grigor'yevich Pavlovskiy.

STATE COMMITTEE FOR PUBLISHING HOUSES, PRINTING PLANTS, AND THE BOOK TRADE

Boris Nikolayevich Pastukhov replaced Boris Ivanovich Stukalin.

SOVIET PERCEPTIONS OF ECONOMIC PROSPECTS

By M. Elizabeth Denton*

CONTENTS

	Page
Summary	30
Introduction	31
Identification of the key economic problems	32
Measurement of the decline in growth	34
Signs of increasing concern	37
Prospects for solving the major problems	39
Consumer welfare	39
Capital formation	41
Energy production	41
Manpower	42
Planning and management	42
Agriculture	43
Technological progress	44
Perception of prospects—A wrap-up	44

FIGURES

1. Selected economic indicators ... 35
2. Growth in per capita consumer welfare ... 36

SUMMARY

The Soviet leadership recognizes it faces a convergence of economic constraints in the 1980s that defies easy solution. The leadership also has a clear idea of what needs to be done. The focus must now be on "intensive" development—that is, rapid productivity gains through the introduction of new technology, improved incentives that encourage the conservation of scarce factors of production, and better planning and management. Soviet leaders seem increasingly concerned that the transition to such development is not being made successfully. They apparently believe that there are no panaceas, only palliatives, for the continuing economic problems.

Consumer welfare.—They see a continued decline in general consumption growth, but hope for some growth in priority consumer areas and that exhortations for greater worker efforts will be an effective stimulus to productivity.

Capital formation.—They realize that a return to high rates of investment growth is neither possible nor practical and hope that smaller investment allocations will encourage more efficient use of plant and equipment.

Energy production.—They are sufficiently concerned by energy prospects to vote a substantial increase in investment resources to

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this sector at a time when overall investment growth is shrinking. In the shorter run, they are taking more urgent conservation measures and are cutting back on energy exports to client states.

Manpower.—They seem convinced that modest measures to save and redistribute labor will compensate to some extent for the slowdown in new entries into the labor force. More ambitious policies can only be implemented slowly because of the stiff competition for investment resources.

Planning and management.—They are disappointed by the slow pace of economic reform but appear confident that tinkering can make the system work.

Agriculture.—They see little hope for significant breakthrough in acceleration of the growth of farm output or for reducing its instability but realize that they must continue to invest heavily in this sector and spend sizable amounts of foreign exchange on imports.

Technological progress.—They see the slow pace of economic reform and the decline in growth of plant and equipment threatening the introduction of new technology and hence productivity goals. Also, a shortage of foreign exchange will reduce their ability to rely on imported technology. Hence they are concentrating on channeling investment funds to sectors considered key to technological progress, and are encouraging the military research and development sector to share its skills with the civilian sector.

The leadership's apparent belief that the decline in Soviet economic performance can be held within manageable bounds without major policy change diverges from the perception of most Western observers, who foresee more severe consequences stemming from this business-as-usual attitude. The measured response is typical of Moscow's aged leaders who have a vested interest in and close identification with the system as it is. They have a penchant for piecemeal measures and count on continued docility by the consumer, who must absorb the major impact of the economic decline. In the end, the leadership looks ahead to the 1990s, which they believe promise some relief from this decade's toughest problems.

INTRODUCTION

An assessment of leadership perceptions is of particular current interest because of the unique challenges that the Soviet economy faces in the 1980s. The simple growth formula used for more than half a century—large infusions of labor and capital—will work no longer because these inputs are becoming more scarce and costly. As a result, large productivity gains are essential for future growth. To understand and perhaps predict Soviet economic policies it is useful to know how the leadership views this changing situation.

The leadership does not specifically address overall economic prospects in public. Bits and pieces of evidence from a wide variety of sources need to be assembled, therefore, to construct a reasonable facsimile of the leadership's perceptions. This paper arranges the evidence in answer to the following questions—deemed to be the most relevant to an assessment of prospects:

> What does the leadership identify as the key economic problems?

According to Soviet measures, how serious is the decline in growth?

Do Soviet leaders display a rising concern about specific problems or economic growth in general?

What do they believe are the prospects for solving specific major problems?

The collected speeches of Brezhnev and Kosygin for 1970 through 1980 were used as a major source. Although voluminous, their public pronouncements are highly general in nature, and rhetoric often obscures substance. Moreover, it is legitimate to question how representative they are of the leadership's true perceptions. Nevertheless, they are the only primary source. Another major source was statements by leading Soviet economists. At the least, their views must have some impact on the leadership's thought processes and, at most, they can be said to share the leadership perspective. An analysis of official Soviet statistics was used to determine Soviet perceptions of past trends in economic growth. Western estimates of Soviet growth performance were introduced to compare the configuration of trends between the two sets of measures. Finally, Soviet policy responses were a source of clues to the degree of concern with which the leadership views specific economic problems.

IDENTIFICATION OF THE KEY ECONOMIC PROBLEMS

The first clue to leadership perceptions of economic prospects lies in its identification of key economic problems. If the weak spots are identified correctly, then a realistic assessment of prospects is more likely.

Throughout the period examined, the leadership was absorbed with the problem of declining economic growth. It acknowledged that a new growth strategy was required, one that emphasized "intensive" and not "extensive" development. Brezhnev put it most simply in a speech to workers at the Kharkov tractor plant in April 1970.

> Many problems are essentially connected with . . . the fact that we have entered a stage of development that no longer allows us to work in the old way but calls for new methods and new solutions.

More specifically, the new growth strategy was recognized as necessary because the basic inputs that were available in such relative abundance in the past—manpower, capital, and raw materials—were becoming more scarce and expensive.

> The so-called extensive factors of growth in the national economy are also becoming more limited; in 1971-75 opportunities for enlisting additional manpower will decline in comparison with the past five-year plan. The growth rates of capital investments also have their limits. [Brezhnev speech to 24th Party Congress—March 1971]

The leadership realized that this decline in resource growth could be offset by a rise in productivity gains and believed the best way to effect this transition to "intensive" development was to "accelerate scientific-technical progress" and improve labor organization and discipline. Various obstacles stood in the way of accomplishing these goals, however. The list below represents an attempt to distill into "first causes" the major obstacles cited in the 11-year file of leadership speeches: [1]

A chronic lag in the completion of investment projects.

> We have still not been able to halt the process of scattering capital investments among numerous construction projects. The amount of unfinished construction is increasing. Uninstalled equipment worth several billion rubles lies around unused in warehouses. (Brezhnev speech to Central Committee plenum—November 1978).

Weak incentives and poor management structure for the introduction of new technology.

> Cardinal changes (are needed) in the style and methods of economic activity, improvement of planning and economic incentives to make possible the swiftest possible transmission of new ideas along the entire chain from invention to mass production. (Brezhnev speech to 25th Party Congress—February 1976).

Weak incentives and poor management structure for the conservation of scarce resources, including manpower and materials.

> Thrift . . . requires new approaches in capital investment policy and in many spheres of technical policy, maneuvering with existing capacities and manpower resources, and the overcoming of departmental and parochial tendencies. It also requires a certain restructuring in planning, in the methods of economic management, in the system of indices, and in material incentives. No matter how complicated this restructuring may be, we cannot get along without it. (Brezhnev election speech—March 1979).

Consumer goods shortages, particularly food, that frustrate worker incentives.

> The entire course of economic development confirms again and again that a Group B [consumer] industry that meets today's demands is an important condition for the effective work of the economy, as a whole and for the improvement of material incentives. [Brezhnev speech to Central Committee plenum—November 1978]

Two additional problem areas that cannot be directly related to the emphasis on "intensive" development are agriculture and transportation. The leadership identifies two parts to the agricultural problem—how to reduce the wide fluctuations in farm output caused by weather and climate variations and how to accelerate long-term growth. The obstacles encountered in the pursuit of these twin goals resemble those in the rest of the economy—lagging technology and poor organization and management.

The transportation problem is seen as a serious growth constraint and the result of a lag in investment allocations that allowed this sector to fall behind the development of the rest of the economy.

Although not an economic problem per se, the size of defense expenditures is a frequent background theme to the leadership discussion of economic growth. It expresses continued concern about the high levels of spending and the consequent burden on the economy.

In addition to the themes reflected in leadership speeches, recently published lists of economic goals for the medium and long term reveal the emphasis on intensive development. Virtually all targets emphasize conserving resources, promoting sectors key to "technical progress," or improving incentives to promote efficiency. The first list was compiled by a commission set up to prepare the

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[1] These problems are abundantly delineated in the speeches of both Brezhnev and Kosygin. Illustrations here are mostly drawn from Brezhnev because his statements are more clear and germane.

"Complex Program of Scientific-Technical Progress and its Social-Economic Consequences to the Year 2000"—the joint task of Gosplan, the State Committee for Science and Technology and the Academy of Sciences. The Commission believed that its efforts should concentrate on seven "urgent problems for the country's social-economic development": (1) Improved structure of capital investment, that is, a substantial increase in the equipment component; (2) Improved "capital construction," that is, higher quality and more timely completion of new plant and equipment; (3) Development of the machine-building sector; (4) Improved management and organization of the "agro-industrial complex;" (5) Provision of the "solvent demand of the population," that is, reduction of the backlog of unsatisfied consumer demand; (6) Solution of the "housing problem;" (7) The problem of labor resources.

The major plan themes for 1981–85 were first enunciated by Gosplan Chairman Baybakov in May 1980. He said that "priority has been given to five programs": The conservation of metal; conservation of fuel; the construction of the Baikal-to-Amur Railroad (BAM) and development of the newly accessible Siberian areas; reduction of manual labor; and increased production of new types of consumer goods.

Later in the year Gosplan's house organ Planovoye khozyaystvo modified these points somewhat and gave more details:

Reduce transport "difficulties," particularly in the railroads.

Improve the fuel-energy balance through the greater use of natural gas and atomic energy, and implement a nationwide energy conservation program.

Improve the work of metallurgy and machine building through such means as reducing the metal content of machinery and developing metal substitutes.

Complete unfinished construction and reduce new construction starts in favor of the reconstruction of existing facilities.

Improve the supply of food, especially meat.

In summary, the problems identified are recognized as the result of both resource and systemic deficiencies that are interrelated. The ultimate problem is how to promote intensive development—that is, rapid productivity gains. The leadership's picture of the challenges confronting the Soviet economy in the 1980s, then, is not unlike that drawn by Western observers.[2]

Measurement of the decline in growth.—Because declining growth is the nexus of the economy's problems, it should be examined quantitatively from the Soviet viewpoint, that is, by using official Soviet measures of economic growth.

Since the inception of the Brezhnev-Kosygin leadership, economic growth has trended downward, particularly since 1970 (see the figures). Although Soviet aggregative statistics show generally higher rates of progress than Western measures, the trends have been remarkably similar. The decline is apparent in both the industrial and agricultural sectors. The pace of the rise in consumer welfare has suffered accordingly. Productivity data clearly show a secular decline, revealing this to be a major reason for the general economic slowdown.

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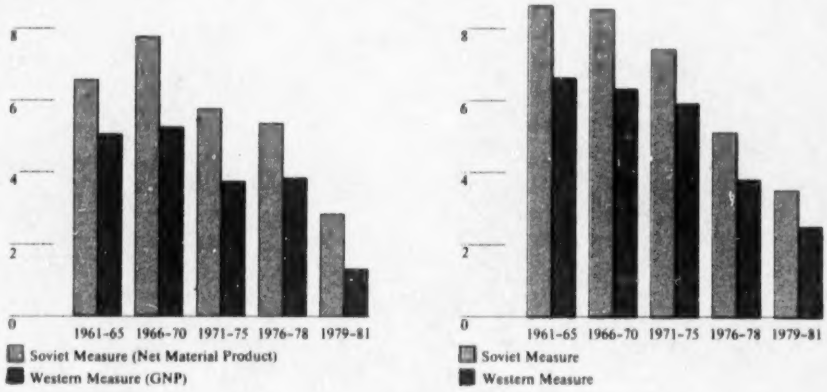
[2] See "Soviet Economic Problems and Prospects," CIA, ER 77-10436U, July 1977.

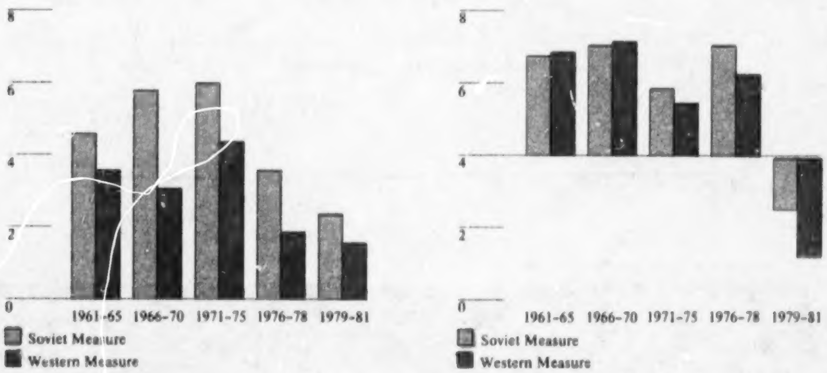
Figure 1

Selected Economic Indicators

Average Annual Percent Rate of Growth


Overall Economic Growth

Industrial Production


Industrial Labor Productivity

Agriculture Production[a]

[a] Three year average.

Unclassified

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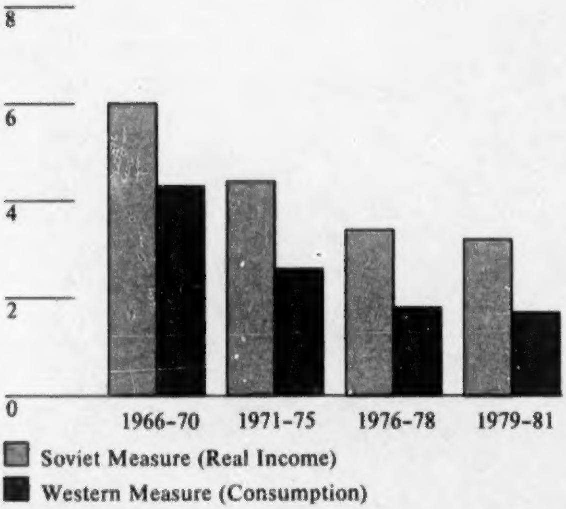
Figure 2

Growth in Per Capita Consumer Welfare

Average Annual Percent Rate of Growth



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[redacted]

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It seems unlikely that the Soviets could take comfort in these statistics, even considering the 1 to 2 percentage point spread above Western estimates of GNP and industrial output growth. The relevant aspect is the downward trend in growth that requires hard-policy choices and increases tensions among competing power groups. A continued rise in resource allocations at past rates for one resource claimant, the military for example, would create a serious squeeze on resources for growth and consumption.

Although official Soviet measures reflect a decline in overall growth similar to that revealed by Western measures, conceptual differences may affect the level of Soviet leaders' concern. The exclusion of most services from Soviet national income, for example, predisposes them to give greater weight to the material-producing sectors. The precipitous decline in industrial production growth during the 1970s, therefore, could look more ominous to the Soviet leadership than to Western observers, who measure growth more comprehensively. On the other hand, Soviet biases in the measurement of industrial output could result in a more sanguine view of their prospects because their upward bias is greatest in those sectors that are most important for technological progress—machinery and chemicals.[3]

Signs of increasing concern.—The evidence suggests that the leadership believes that the major economic problems are serious. But does the leadership believe that the economy's problems are getting worse, and, if so, which ones are becoming particularly intractable? Answers to these questions have obvious repercussions on their perception of the future.

The leadership speeches during 1970–80 do in fact indicate a substantial rise in concern in three major areas-energy, planning and management, and consumer welfare. The level of concern expressed for the remaining problem areas was relatively steady throughout the period.

Energy.—During the early 1970s the energy-related portion of the leadership speeches was limited to general statements about the need for "raising the efficiency of the fuel and power complex, increasing the share of petroleum and gas in the fuel balance, and expanding the construction of atomic power stations." (Brezhnev speech to the 24th Party Congress—March 1971.) There was no sense of urgency concerning attainment of output and requirements targets. By early 1976 it was apparently felt necessary to assure the public that fuel shortages "as a rule" were not expected.

> As a rule, our plans will provide for faster growth rates for proven reserves of minerals than for their extraction, so that the levels of their supply to production will always be adequate. This will enable us to continue to guarantee the national economy against shortages of energy and raw materials. (Kosygin speech to 25th Party Congress—March 1976)

Later that year it was admitted, however, that "requirements are growing faster than resources. . . . Rigid consumption coefficients (and) great efforts to improve the efficiency of all branches of heavy industry" were needed if there was to be "uninterrupted satisfaction of the economy's growing requirements for . . . energy." (Brezhnev speech to Party plenum—October 1976.) By 1978 Brezhnev indicated an impatience with the conservation effort and for the first time admitted that energy shortages were causing problems in other sectors.

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[3] The possible bias from increased double counting, for example, is greatest in industries with a high ratio of material inputs to gross output such as machinery, chemicals, and construction materials. The bias caused by disguised inflation is most common in industries with a heterogeneous assortment of products and in technically dynamic industries, features most characteristic of the machinery and chemicals branches.

> Fuel continues to limit us. . . . There has been virtually no reduction in wastes and losses. . . . This creates difficulties in a number of branches of the national economy. (Brezhnev speech to Central Committee plenum—November 1978)

Planning and management.—On the subject of planning and management, the interesting aspect is not the growing urgency of the rhetoric, as with the energy problem, but the continued plea for improvement despite the introduction of countless "reforms" throughout the period. These years included the ostensible completion of the 1965 reforms,[4] the creation of "production associations,"[5] the introduction of labor-saving experiments such as Shchekino,[6] and the initiation of the most recent "comprehensive" reform of mid-1979.[7] Yet the leadership continually noted that (a) the current reforms were not being successfully implemented, and/or (b) further reforms were necessary.

By the turn of the decade, Brezhnev was still making vociferous attacks on the failure to adequately "restructure the economic mechanism."

> A certain restructuring in planning, in the methods of economic management, in the system of indices and in material incentives (is needed) . . . no matter how complicated this restructuring may be, we cannot get along without it. (Brezhnev election speech—March 1979) It should be frankly admitted that the mechanism of management and planning, the methods of management and the discipline in carrying out assignments have not yet been brought to the level meeting contemporary requirements. (Brezhnev speech at Central Committee plenum—October 1980)

Consumer welfare.—Consumer frustrations as a damper to work incentives have been a recurrent theme in the speeches. As early as 1971 Brezhnev made the connection between the "well-being of the worker" and "rapid production growth." In the last several years, however, as growth in labor productivity has declined steadily, this linkage has been made more frequently and elaborately. In 1978, for example, Kosygin promoted the importance of fulfilling consumer service goals—while Brezhnev emphasized the output of consumer goods.

> The task of improving efficiency and quality should be persistently tackled not only in the sphere of production but also in the sphere of services to the population. . . . The service sphere is a sphere that is used by all citizens all the time, one that does a great deal to determine their mood and to influence their attitude toward their jobs and toward those around them. (Kosygin speech on the occasion of the 61st anniversary of the October Revolution—November 1978)
>
> A Group B (consumer goods industries) that meets today's demands is an important condition for the effective work of the economy as a whole and for the improvement of material incentives. (Brezhnev speech to Central Committee plenum—November 1978)

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[4] The major reform of the Brezhnev-Kosygin regime that stressed profit and economic "levers" as a way to improve efficiency.

[5] The merger of industrial enterprises to reap gains from specialization, obtain economies of scale, and save on administrative costs.

[6] Introduced in 1967 at the Shchekino Chemical Combine to allow enterprises to keep the wage fund savings obtained through labor force reductions.

[7] Reform of planning and incentives that includes an attempt to replace the gross value of output indicator with a net output concept.

The use of the word "mood" became more common in both leaders' vocabulary. In effect, it suggests heightened concern over solving the consumer question since "mood" could be a euphemism for the threat of civil discontent.

The economy in general.—More generally the leadership evidently believes that current economic problems are unprecedented in complexity and scope. Evidence of this is the pessimism that has been allowed to creep into statements by major economic spokesmen. Gosplan Chairman Baybakov's bleak picture of the economy in an academic journal in May 1980 serves as a good example, particularly since his style is usually reportorial if not upbeat.

> The rates and absolute size of the growth of the national income and the output of industry and agriculture for four years of the present five-year period will be less than we intended. To a considerable extent this situation is explained by the fact that we have been unable to achieve an abrupt change in direction in raising the efficiency of social production . . . without a radical improvement of affairs in the field of scientific-technical progress, it will not be possible to perform these large tasks which the party and government are setting.

PROSPECTS FOR SOLVING THE MAJOR PROBLEMS

The leadership is adept at pinpointing shortcomings but rarely articulates the chances of finding timely solutions or their likely effect on general economic growth. For this we must turn to statements by high-level officials and economists, who probably share the leadership perspective. Also, actions already implemented or in the proposal stage are good clues to leadership views of prospects. For example, the adoption of draconian measures presumably would be a logical response to a problem viewed by the leadership as particularly threatening to growth prospects. In this section these sources will be used to explore the leadership perspective on specific major problems including the consumer, investment, energy, manpower, planning and management, agriculture, and technological progress.

Consumer welfare.—The leadership seems aware that the consumer has already borne much of the burden of declining growth, especially in poor harvest years. But do the Soviet leaders believe that consumption growth will continue to decline and, more importantly, are they confident that they can make this palatable to the populace? The evidence presented below suggests that the leadership believes that the decline will continue and will be serious enough to require some revision in policies and attitudes in order to restrict demand.

Nonetheless, Soviet leaders probably believe that they can deliver some gains in priority consumer areas such as quality foods to workers in key industrial sectors. Moreover, they appear convinced that exhortation and a more differentiated wage structure will provide an effective spur to productivity.

The most tangible evidence that the leadership expects only minimal improvement in general consumer welfare is the recent emphasis on finding ways to restrict consumer demand rather than on expanding the output of consumer goods. A Kommunist article by Gosbank Chairman Alkhimov in late 1979 listed several ways of increasing the output of consumer goods but devoted the major portion to methods of dampening demand. These included the limitation of "unjustified," (i.e., not tied to labor productivity) increases in wages and strengthened control by central administrative organs and banks over wage payments resulting from above-plan construction and repair work. Also, five price increases on "nonessential goods" have been implemented since 1977.

There are some indications that the leadership may be considering more radical measures to restrict demand—monetary reform and price rises on essential consumer goods. Rumors have circulated for several years that a currency exchange is imminent, designed largely to reduce the large lump of liquid holdings embodied in savings deposits and cash hoards. The possibility of a price increase on "basics" has been hinted at in recent years, although the events in Poland may have postponed consideration of this action. During a discussion of the wholesale price reform schedule to begin in 1981, for example, the Chairman of the State Committee on Prices promised only that retail prices would not be raised during 1976–80 but implied that a continued freeze would be unreasonable.

The necessary restrictions on demand may not appear as severe to the Soviets as to us because they expect a modest growth in per capita consumption during the 1980s compared with Western scenarios that project little or no growth in per capita consumption. Soviet emigres over the last several years have emphasized that the consumer's perception of some forward movement is essential for holding the lid on consumer discontent.[8]

If leadership expectations for continued growth in consumer welfare appear untenable, it could concentrate its limited resources on projects with high visibility. The continued pledge to improve the diet backed by massive imports of grain and meat falls in this category. Also, the new Soviet Constitution of 1977 contains more permissive language that indicates an intent to loosen restrictions on the private sector. An expansion of private consumer services and farm output in particular could make a difference at the margin, while entailing small expenditures of state resources. No action has as yet been taken in the private service area but a party and government decree published in December 1980 makes it more economically attractive for state and collective farms to give support to the private plots.[9]

Finally, the leadership proabably believes that it has the power to motivate Soviet workers even if living standards stagnate. First, wages will be tied more closely to individual productivity, reversing the more egalitarian policy favored in the past. Secondly, recent pronouncements make it clear that the worker will be continually reminded that a rise in consumer welfare depends directly on his own efforts. Typical of this approach is a Pravda editorial of October 1980.

> Soviet people know well that the party and state have no concern higher than that for the people's welfare. Soviet people also know that their welfare is created by their own labor and by nothing and by no one else and that only what man has produced and created can be distributed and consumed. That is why they are fully

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[8] Several Western observers of the recent Soviet domestic scene have written about the new pessimism of the Soviet consumer regarding future improvements in the living standard. See John Bushnell, "The New Soviet Man Turns Pessimist," Survey, Spring 1979, Volume 24, No. 2; and George Feifer, "Russian Disorders," Harpers, February 1981.

[9] See Ann Lane, "Private Agriculture on Center Stage" in Part VII of this JEC volume.

> determined to work selflessly for the benefit of the motherland and that means for their own benefit.

Capital formation.—The leadership seems convinced that a return to high rates of investment growth will not raise growth in national income to previous levels. It also understands that the growing scarcity of easily exploitable raw materials is a major reason for the rising investment cost per unit of additional production. At a general meeting of the Soviet Academy of Sciences in December 1979, the prominent economist Abel Aganbegyan described this phenomenon graphically.

> The capital investment required in the 1980s to yield 1 ruble of increased output of fuel and raw materials will be at least two and a half times the 1965 figure.

Instead of stepping up the annual growth in investment to compensate for the decline in capital productivity, investment has grown slowly. Investment growth in the 1976-80 plan was set at the historically low rate of 3.5 percent per year, and the five-year plan for 1981-85 projects an even lower rate—less than 2 percent each year. In an editorial of his Academy's journal in October 1979, Aganbegyan discussed why a return to high investment rates is both undersirable and impractical. He acknowledged that the resources currently available cannot support investment at past rates, and moreover, the consumer will not be sacrificed to do so.

> Growth in capital investment has slowed considerably . . . . This stems from the need to increase the share of the consumption fund in the national income and to balance the growth in capital investments with the country's ability to produce rolled metal, building materials, and equipment.

Despite the obvious implications for economic growth, the leadership may not view the planned decline in investment growth with great alarm, at least in the short run. They apparently believe that a cutback in investment will force a more efficient use of plant and equipment. This has been one of the purported motivations behind restraining investment growth during 1976-80 and during the current plan. The hope is that restrictions on new construction starts and concentration on unfinished construction will bring new plant and equipment on stream faster, thereby raising capital productivity somewhat.

Energy production.—Soviet leaders have been aware since well before the Western oil crisis of 1973-74 that they had a far more serious energy problem than they were prepared to acknowledge in public. But in 1977 their actions indicated that their appreciation of the problem had deepened. At the December Plenum of the Central Committee the Soviet leadership significantly altered the energy policy of the 10th Five-year Plan (1976-80). Instead of following what had been a "balanced" policy of stabilizing and then gradually decreasing the share of hydrocarbons while simultaneously increasing the share of coal and nuclear power, the leadership shifted to a narrower, all-out campaign to develop oil and gas production in Tyumen Oblast over the next decade.

Uncertainty probably best characterizes Soviet judgments about future oil prospects. Nonetheless, there has been little evidence of what could properly be called a comprehensive and operative Soviet energy program. Energy production decisionmaking has not been seriously influenced by any carefully elaborated and stable "master plan." The process of decisionmaking in this crucial area seems far more ad hoc than is customarily assumed by either Soviet propagandists or many Western analysts.

At present the policy is to increase investment funds substantially to the energy sector. During 1981-85, compared with 1976-80, they plan a 50 percent increase in energy investment and a 63 percent jump in oil industry investment compared with an overall investment growth rate of only 10.4 percent. Measures taken with a shorter-run impact include more urgent energy conservation and a cut-back in energy exports to selected client states.

Manpower.[10]—The regime has been slow to respond to the impending manpower shortage—even though Soviet specialists have warned about the shortages for the past decade. Apparently the leadership believes that radical measures are not needed. An awareness of the profligate use of manpower and a consequent belief in the presence of enormous "hidden reserves" may explain the leadership's attitude.

Manpower-related measures already taken fall into four broad categories designed to

improve and expand training;

stimulate a greater supply of labor such as revised pension laws to encourage work beyond retirement;

improve efficiency including increased penalties for high labor turnover and lax discipline; and

improve labor allocation through more strict work assignments and administrative controls.

Effort in three other areas have the potential for a bigger but longer-term payoff—automation and mechanization, use of surplus manpower in Central Asia, and measures to increase the birth rate. However, the leadership has been slow to implement or even clearly formulate policies in these areas, either because of regional sensitivities or the need for large investment outlays not currently available. During the 1980s, for example, Central Asia will face stiff competition for any new investment rubles from Siberia and the European USSR.

Planning and management.[11]—Leadership statements adequately attest to its disappointment with past reforms in the area of planning and management. But do the leaders conclude that a more fundamental reform—one that would truly change the system's basic operating procedures—is necessary? An examination of past reforms indicates that Moscow remains eternally optimistic that a perfection of the current "economic mechanism" is not only possible but desirable. Although impatient with the slow progress of the reform movement, they continue to expect that the next reform will be the one that makes all the others fall into place. With such a mindset, it seems unlikely that the leadership would introduce radical economic reforms involving the introduction of market arrangements—ones that have a better chance of boosting productivity.

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[10] See Goeff Schleifer and Ann Goodman, "The Soviet Labor Market in the 1980s" in Part VI of this JEC volume.

[11] See Gertrude Schroeder Greenslade, "Soviet Economic 'Reform' Decrees: More Steps on the Treadmill" in Part I of this JEC volume.

One factor arguing for the retention of highly centralized planning is the belief in some quarters that more sophisticated planning techniques backed by computers will eventually make the system work. Some Western specialists believe that the use of more technical equipment has already contributed to the production of more solidly based plans than in the past and that the plan-making process will continue to improve in the future.[12] The touting of automated systems of management reportedly is a central theme in the curriculum of the Economic Management Institute in Moscow. This Institute was created in the 1970s to introduce progressive (including Western) business techniques to senior Soviet managers.

Agriculture.—Of the seven party plenums devoted to specialized economic topics since 1965, five dealt with agriculture. The leaders seem resigned to pouring huge amounts of resources into this sector with no guarantees of a real breakthrough in stability or size of output.

The leadership consensus seems to be that the share of resources allocated to agriculture cannot be reduced without risking the gains already achieved although it acknowledges the heavy burden on the rest of the economy. In his plenum speech of October 1976 outlining the new 1976–80 plan, Brezhnev called the investments in agriculture "a huge sum" and said that "frankly it was not easy to find it . . . we had to somewhat curtail the demands of other branches of the economy." But this was necessary "because now there is no more pressing task" than increasing agricultural production. In a special plenum on agriculture in July 1978 Brezhnev attempted to stake an early claim for agriculture in the 1981–85 plan. At the plenum in October 1980, Brezhnev again pressed for "big capital investments and material resources for agriculture." Apparently this strategy worked. Although agricultural investment during 1981–85 will not grow as fast as in 1976–80, it will still command its former share (over one-fourth) of total investment resources.

While continuing to remain pessimistic about substantial breakthroughs in output and efficiency in the farm sector, the Soviet leadership probably believes that it can muddle through by adopting piecemeal measures such as:

> Reallocation of resources from production to transportation, storage and processing to reduce high rates of losses. The 1981–85 plan directives emphasize the development of the "agro-industrial complex" and pledge "almost one-third" of total capital investment to this combined effort. A new "food program" to encompass all of these sectors was unveiled at the May 1982 party plenum.
>
> Tinkering with planning and management. A December 1980 party-government decree reduces the number of obligatory planning indicators given to both state and collective farms, raises prices for above-plan sale of products, and increases individual incentives for such things as raising labor productivity and preventing cuts in livestock herds.

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[12] See Joseph S. Berliner, "Planning and Management", in Conference on the Soviet Economy Toward the Year 2000, September 1980.

Expansion of the private sector. In January 1981, Moscow published a decree stressing the importance of private plots and encouraging greater support of this sector by state and collective farms. Brezhnev, in his 26th Party Congress speech (February 1981), described the private sector as a prime source of additional meat supplies and promised additional assistance including forage and equipment.

Technological progress.—Leadership perceptions of prospects for "the acceleration of scientific-technical progress" (that is, productivity) are inextricably linked with its perceptions of prospects for reform and capital formation. Disappointed with the pace of the general economic reforms and resigned to a substantial decline in investment growth, the leaders realize that this goal will be even harder to achieve during the 1980s. In order to limit the damage of a slowdown in investment, they are concentrating resources on those sectors that are most important to technical progress; machine building, the chemical and petrochemical industries, and energy.

During the 1970s the Soviets tried to boost productivity with massive imports of Western technology and machinery. Soviet economic prospects for this decade argue for a continuation of this policy. However, as a result of an expected decline in oil exports, Moscow will be losing its major foreign exchange earner and will not have the cash to buy Western goods and equipment in the volume it has in the recent past. The leadership will have to depend more on reforms in civilian R&D and spinoffs from military R&D.

The Soviets continue efforts to improve the performance of their domestic R&D sector. In July 1979 the Central Committee-Council of Ministers decree on planning and management included specific measures for raising the incentives of R&D organizations and strengthening ties with their customers. Shortly after, Brezhnev encouraged the military R&D sector to share its talents and know-how with the civilian sector. Referring to the importance of developing the machine-building sector, Brezhnev said:

> To this we should orient our strongest scientific collectives. I have in mind, besides the Academy of Sciences, scientists and designers working in the defense branches. I believe that their contribution to the development of the economy of the country can be wider and more varied. The Council of Ministers, jointly with specialists should be instructed to determine precisely what scientific and design collectives of the defense industry could assist some or other types of civil machine building, could give assistance in the development of highly effective and high-quality types of machinery, in drawing up concrete programs and assignments. [Speech to party plenum—October 1980]

PERCEPTION OF PROSPECTS—A WRAP-UP

The leadership admits that the Soviet economy is being challenged by a convergence of unusually serious problems. Moreover, the transition to intensive growth, the required response, is not perceived as going smoothly. As a result, a sober appraisal of economic prospects has been made, reflected in the moderate goals of the 11th Five-Year Plan published in November 1981.

Despite the serious nature of this assessment, the leadership has given no indication that it is ready for real systemic reform. Its business-as-usual attitude is apparent in the new plan directives for 1981-85—a familiar litany of problems and proffered solutions that contain no detectable attempt to rethink their plan of action. This is the most telling evidence available that they believe the general decline in growth can be held within manageable bounds and that it will not damage vital interests such as the ability to maintain a formidable defense posture or to retain the allegiance of the consumer/worker. Some tentative hypotheses can be offered to help explain their measured response.

First, the leadership is unlikely to make radical changes because it has an obvious vested interest in retaining the present system. More than that, however, the leaders' speeches and articles, even considering their rhetorical nature, indicate a firm belief in the system.

Secondly, a reliance on piecemeal measures is standard operating procedure for the Soviet leadership. The leadership's advanced age ensures that this type of response will continue; modest measures with some hope of immediate impact will be favored over grandiose schemes that promise long-run benefits but would be disruptive to the regime's final years.

Thirdly, despite the lessons of Poland, they apparently are gambling that the stoicism of the long-suffering consumer, who will bear the brunt of the economic decline, will remain unchanged. In any event, they probably believe that a strict police crackdown would be sufficient to control any civil discontent over consumer problems—although some productivity would surely be lost.

Finally the most probable cause for the leadership's relaxed response to the current economic sitaution is its ability to look ahead to better times in the next decade and to see the 1980s as only part of a continuum. The decade of the 1990s promises some relief from at least two of the major problems—manpower and fuels. Although major increments to the labor force will not appear even in the next decade, the decline will have at least bottomed out. In the energy area, the Soviet leaders probably are counting on large new discoveries of oil as well as alternative energy sources coming on stream.

ADMINISTRATIVE REFORM AND SOVIET POLITICS

By Paul Cocks

CONTENTS

Page
Summary 46
Introduction 47
Groping toward a new approach 48
  Target programing 49
  Administrative restructuring 51
The party's role in target programing and economic management 52
Implications and prospects 55
  Economic policy and planning 55
  Bureaucratic politics and leadership succession 56
  Administrative restructuring and economic reform 57
    Governmental reorganization 59
    Party reform 59
  Military-civilian relations 60
  Foreign dimensions 62

SUMMARY

The Soviet leadership is moving toward a new approach to economic planning and management. The Politburo is trying to improve the cumbersome coordination process, overcome the diffusion of authority among the many overlapping government ministries, and gain a tighter hold on national priorities. Two kinds of administrative measures in particular are being taken: (1) Special goal-oriented programs are being drafted and included in the 11th Five-Year Plan (1981-85) to focus attention and resources on high-priority civilian economic problems—energy, food, conservation of resources—that transcend traditional lines of bureaucratic authority and fall victim to fragmented management; (2) Special monitoring and troubleshooting commissions are being created at the apex of the government—under the Presidium of the USSR Council of Ministers—to oversee management of target programs and to force interagency coordination. In the last 18 months three such commissions—all headed by deputy premiers—have been set up, and others may be in the offing.

Moscow is attempting to apply project planning and management techniques—Soviet-style "management by objectives"—developed in the defense sphere to critical problems in the civil sector. The administrative changes at the Council of Ministers appear aimed at institutionalizing to some extent civil economic counterparts to the Military-Industrial Commission (VPK), which oversees coordination of defense programs. These efforts, however, do not constitute a genuine reform of the economic system and are not likely to be ef-

fective. Rather, they reinforce the system's traditional bureaucratic features by increasing centralization and control.

Though not radical or innovative, this approach is nonetheless highly controversial because it threatens to undermine political-administrative arrangements that have prevailed for nearly two decades. In pressing the target-program approach and the pace of management restructuring over the past two years, Brezhnev has drawn the party apparatus more directly into economic decisionmaking and has blurred party-state roles and responsibilities. That he is willing and able to embark on this path reflects, in part at least, heightened leadership concern and a growing sense of urgency over the troubled economy. Whether this approach will survive him, however, is not certain. The key decisions and policy choices for the next plan will be made at a time (1983–1984) when leadership maneuvering and succession politicking are likely to be especially intense. At the same time, the political uncertainty and risk generated by the succession process will probably constrain both the pace and scope of administrative reform.

This approach could also add a new dimension to military-civilian relations. The formerly unique position of the VPK reflected clearly the priority of military over civilian needs. The creation of other commissions under the Council of Ministers Presidium probably has caused some concern in military and political circles that the military may lose some of its privileged status and that civilian priorities increasingly may compete with defense programs for scarce resources and leadership attention. Should the new commissions and target programs begin to encroach on the activities, prerogatives, and interests of the military-industrial complex, such apprehension would mount rapidly and impact significantly on leadership debate and the political succession.

On another level, the target-program approach may have added impetus to leadership concern over Soviet vulnerabilities and weaknesses exposed by recent Western trade sanctions and technology embargoes. The programs suggest some regime efforts are under way to reduce economic dependence on foreign imports over the long run and to limit Western political leverage.

INTRODUCTION

As the presuccession struggle gathers momentum, the improvement of economic organization and management—a perennial problem that has become a key issue in succession politics in the past—is once again rising to the top of the Soviet leadership's agenda. Ever since the summer of 1979 the Brezhnev regime has seemed bent on renewed comprehensive efforts to improve performance and the basic workings of the so-called economic mechanism. Administrative improvement for national development thus is a pressing matter. General Secretary Brezhnev noted in November 1981 that the Politburo had decided to air the whole question of organization and management at a forthcoming meeting of the Central Committee. A senior party official indicated in May that a special plenum on management is currently in the works and could take place this fall.[1]

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[1] See Soviet World Outlook, VII, 4 (May 15, 1982), p. 6.

In particular, the planning and management of key large-scale development problems that cut across ministerial and regional boundaries have moved to the center of the economic debate. These problems—improving the food supply, restructuring the energy balance, raising labor productivity or developing new natural resource bases—have important technological and social components. They represent the new "commanding heights" of the economy in this decade and possibly the next. Future economic growth, technical progress, and an improved standard of living hinge on how well the Soviets deal with them. Yet, it is increasingly evident that the prevailing bureaucratic structure and methods of economic and political administration are inadequate to the task.

This paper along with others in this volume examines recent responses by the Soviet leadership to unusually serious questions about the functioning and future of the economy.[2] It describes Moscow's development of new approaches to the planning and management of high priority national programs. It examines the growing intervention of the party bureaucracy in economic decisionmaking and the leadership debate that this party involvement has prompted. In the final section, the paper discusses the economic and political implications of these new approaches and assesses their possible impact on leadership succession, administrative reform, military-civilian relations, and foreign trade policy.

GROPING TOWARD A NEW APPROACH

Soviet leaders recognize that dealing with major civilian development projects in the customary way (without their separate indentification and full integration in the Five-Year Plan and through normal adminisrative channels) is ineffective. Such projects have fallen victim to divided responsibility, fragmented organization, and piecemeal solutions. Built predominantly along rigidly hierarchical and narrowly compartmental lines, the Soviet administrative system lacks effective mechanisms for securing the kinds of close interaction, cooperation, and integration needed for these multiagency policy efforts.[3]

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[2] See particularly the contributions by Gertrude Schroeder, Beth Denton, and David Kamerling.

[3] At times, the Soviets have created special management systems, headed by councils or commissions subordinated to the highest organs of the government, to make policy and ensure resource allocation for certain priority programs, such as for the nuclear and space programs. Isolating such national programs as special objects of high-level management has been clearly the exception, however. In general, responsibility remains undefined or diffused, and special organizational arrangements to facilitate coordination have not been made or fall short of the mark. For discussion of Soviet approaches to this class of problem, see Julian Cooper, "Innovation for Innovation in Soviet Industry," Center for Russian and East European Studies, University of Birmingham, England, 1979, pp. 41–43; B. Budavey, "Programmno-tselevoy metod v narodnokhozyaystvennom planirovanii," Voprosy ekonomiki, 1 (1978), p. 5; G. Popov, "Programmno-tselevoy podkhod v upravlenii," ibid., 2 (1977), pp. 56–65; B. Milner, L. Evenko, and V. Rapoport, "Upraveniye narodnokhozyaystvennymi programmami," ibid., 6 (1979), 33–43; and A. Kochetkov, D. Levchuk, and B. Milner, "Upravleniye krupnymi proizvodstvenno-khozyaystvennymi kompleksami," ibid., 10 (1981), 64–72.

Currently, the controversy centers on whether existing bodies, with some limited reorganization and changes in their powers, should act as lead agencies for programs or whether new, temporary program management bodies should be created. These questions concern more broadly problems of redefining the roles and responsibilities of interbranch functional agencies (especially Gosplan and other state committees), of branch ministries and departments, and of territorial organs as well.

Continued

The leaders apparently do not intend to supplant the basic branch-of-industry and territorial dimensions of the existing planning and management system. Rather, their efforts are geared toward drafting goal-oriented programs to focus attention and resources on priority problems that crisscross sectoral and regional lines and toward supplementing the existing system by building a "program" frame into it.[4] Institutionally, the leadership appears to be creating, to some extent, civil economic counterparts to the Military-Industrial Commission (VPK).[5] These commissions, under the USSR Council of Ministers Presidium, provide integrating mechanisms to monitor and steer high-priority programs through the bureaucracy.[6]

Target programing.—For the 1981–85 plan the Soviets drew up for the first time a list of top-priority economic and social problems (see table) for which special target programs are being drafted. These programs are to be formally incorporated into the plan as

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General responsibility for organization and administration of complex programs is usually entrusted to a "head" ministry or department. In practice, however, the powers of head ministries are inadequate to ensure effective operational control of participants belonging to other ministries. An April 1982 article in Kommunist noted that the question of clarifying and expanding the specific functions and prerogatives of head ministries "has been raised frequently but in vain. The problem is that some departments have no intention of surrendering their rights." (p. 48) Another Soviet management expert similarly stated in November 1981, "The economic mechanism, in fact, has functioned apart from [the system of head ministries]." (Yu. V. Subotskiy, "Otraslevoe proizvodstvo i vedomstvennaya razobshchennost'," Ekonomika i organizatsiya promyshlennogo proizvodstva, 11 (1981), p. 17).

[4] The cost of some of the largest programs equals and even exceeds that spent on the development of entire branches of the national economy. Writing in the official planning journal in June 1979, one Gosplan expert estimated that the target programs may consume up to 20 to 25 percent of all resources allocated for development of the economy (B. Raizberg, "Voprosy perspektivnogo planirovaniya i razrabotki tselevykh program," Planovoye khozyaystvo, 6 (1979), pp. 26–27). In September 1980 another Soviet specialist suggested that the target programs should not garner more than 15 to 20 percent of all capital construction funds (I. Shilin, "Khozyaystvennyy mekhanizm: strategiya sovershenstvovaniya," Kommunist, 14 (1980), 33–34.)

The size of the share of capital investment devoted to these programs has itself been—and is likely to continue to be—a subject of heated controversy within the leadership. Too many long-term and very costly projects could constrain even further the already limited flexibility of economic planners in the new era of scarcity when capital investment is expected to grow even more slowly. The number of programs also must be limited lest the priority principle becomes diluted. For a discussion of current Soviet perceptions and goal-oriented approaches, see N. P. Fedorenko, "Target-Oriented Planning and Management," Social Sciences (Moscow), X, 4 (1979), 115–116; Milner et al, "Upravleniye narodnokhozyaystvennymi programmami," p. 43; D. Bakhrach, "Programmno-tselevyye struktury v sovetskom gosudarstvennom upravlenii," Sovetskoye gosudarstvo i pravo, 1 (1980), 35–43; B. Milner, "Kak preodolet' razobshchennost'," Sotsialisticheskaya industriya, Mar. 24, 1981; and E. Gorbunov, "Sbalansirovannost' struktury narodnogo khozyaystva," Voprosy ekonomiki, 4 (1982), 102–112.

[5] The VPK oversees and coordinates military research, development, and production programs. It provides liaison and mediation for the Ministry of Defense, the military-industrial ministries, Gosplan, and the party. For a discussion of the role of the VPK, see Arthur J. Alexander, "Decision-Making in Soviet Weapons Procurement," Adelphi Paper No. 147/8 (Winter 1978/79), p. 21, and Abraham S. Becker, "The Burden of Soviet Defense: A Political-Economic Essay" (RAND R-2752-AF), October 1981, pp. 50–55.

[6] One Soviet expert, M. K. Bandman, summarizes the general role of these high-level commissions as "coordinator and monitor as well as arbiter and judge in interdepartmental disputes." (See EKO, 3 (1981), p. 82). Setting up special commissions under the Council of Ministers Presidium is not a new innovation. Such commissions have often been formed to handle specific tasks, but they are usually ad hoc and temporary bodies. Similarly, USSR deputy premiers have long exercised general coordination for related branches of the economy or for special policy areas. As with head ministries, however, the specific powers and executive oversight functions of deputy premiers have been poorly defined, and they apparently have only a small support staff to help them conduct their business. For a discussion of the organization of the USSR Council of Ministers and of its procedures, see M. S. Smirtyukov, Sovetskiy gosudarstvennyy apparat upravleniya (Moscow, 1982).

In a sense, then, the creation of the new Presidium Commissions to monitor specific target programs may be seen largely as an effort to institutionalize on a more formal basis arrangements and methods of coordination that have been conducted predominantly on an informal basis in the past but are no longer effective in the contemporary Soviet setting.

soon as they are ready.[7] The Soviets describe these superprograms as the "main links" and "backbone" of the current plan and economic strategy.[8]

Economic and Social Comprehensive Target Programs for the 1980s[*]

Programs oriented to solving economywide problems: Food, increased production of new consumer goods, reduction of the use of manual labor, conservation and rational utilization of raw materials and energy, extensive use of chemicals, comprehensive use of minerals, and production of extremely scarce materials that are largely imported.

Programs dealing with specific priority sectors: Machine building, fuel and energy complex, transportation, and metallurgy.

Regional crash development programs: Development of the West Siberian oil and gas complex, construction of the Baikal-Amur Mainline (BAM) Railroad and economic development of the BAM zone, agricultural redevelopment of the RSFSR's nonchernozem zone, and development of the Angara-Yenesey region in East Siberia.

(Sources: B. I. Gostev and A. F. Rumyantsev, eds., Sovetskaya ekonomika na novom etape (Moscow, 1981), p. 204; F. Kotov, "Glavnyye zadachi, tempy i proportsii odinnadtsatoy pyatiletki," Voprosy ekonomiki, 7 (1981), p. 15; A. Aganbegyan, "Programma Sibiri," Sotsialisticheskaya industriya, May 8, 1981; Ekonomicheskaya gazeta, 1 (1981): 2; Kommunist, 10 (1981): 37–38; A. Bachurin, "Kompleksno sovershenstvovat' planirovaniye, upravleniye i metody khozyaystvovaniya," Planovoye khozyaystvo, 1 (1981): 22; V. Ivanchenko, "Sovershenstvovaniye planovogo rukovodtsva ekonomikoy," Voprosy ekonomiki, 10 (1980): 128; B. P. Plyshevskiy, Effektivnost' obshchestvennogo proizvodtsva (Moscow, 1981), p. 62; N. Baybakov, "Ekonomicheskaya strategiya KPSS na sovremennom etape," Partiynaya zhizn', 6 (1982): 25.)

The actual status of these target programs remains unclear. Both General Secretary Brezhnev and First Deputy Premier Ivan Arkhipov stressed last November the novelty and difficulty of drawing up comprehensive programs and negotiating their passage through the bureaucratic machinery.[9] While joint party-government decrees issued since mid-1981 provide a framework of authorization for several programs, and general methodological guidelines have been developed for drafting target programs, the specific details for most of them have not yet been worked out. Some programs still appear to exist in name only. In January 1982 a deputy chairman of the USSR State Planning Committee (Gosplan) implied that only 11 of the 15 comprehensive programs were fixed enough to have been written into the 1981–85 plan when it was approved last year.[10] In March 1982, Gosplan Chairman Baybakov referred to only 14 superprograms, which suggests that one may already have been dropped from the priorities list.[11]

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[7] Some of these programs, like the construction of the Baikal Amur Mainline Railroad or the redevelopment of the RSFSR's non-chernozem zone, are not new. They existed as separate line items in the Tenth (1976–1980) and apparently even in the Ninth (1971–1975) Five-Year Plans, but they were not fully integrated with all sections of the plans and frequently amounted to little more than the sum of separate (and uncoordinated) branch and regional assignments. What is new about the Eleventh Five-Year Plan is that the leadership has formally drawn up a list of priority problems, fixed their number, and is engaged in a comprehensive effort to program and fully include them with all the requisite accommodations and resource adjustments made throughout the structure and content of the five-year plan.

[8] See Fedorenko, "Target-Oriented Planning and Management," p. 114; A. Aganbegyan, "Put' k sovershenstvovaniyu tekhnologii planirovaniya," Kommunist, 10 (1981), 37; and A. G. Aganbegyan, B. Z. Milner, and G. Kh. Popov, eds., Programmno-tselevoye upravleniye sotsialistickeskim proizvodstvom (Moscow: 1980), pp. 28, 31.

[*] These programs are tentatively identified from various Soviet publications. Soviet leaders have not issued a full list of the "15" target programs. The Draft Guidelines for the 1981–85 plan, approved by the party congress, referenced only 7 programs, The various partial lists provided by Soviet sources suggest differences in perceptions of priority among bureaucratic groups and individual experts as well as differences in degree of program preparation.

[9] Pravda, Nov. 17, 1981 and I. Arkhipov, "Reshaya strategicheskiye zadachi pyatiletki," Kommunist, 16 (1981), p. 37.

[10] A. V. Bachurin, "Na osnove novykh metodov Khozyaystvovaniya," Ekonomicheskaya gazeta, 1 (1982): 2.

Even the most widely touted target programs, moreover, are still caught up in bureaucratic and methodological bottlenecks. Although the May 1982 plenum of the Central Committee finally approved the basic guidelines for the long-awaited food program, many details have yet to be worked out.[12] Last November President Brezhnev also criticized delays in developing the program for reducing the use of manual labor.[13] The West Siberian oil and gas complex, according to Soviet Academician A. G. Aganbegyan, still has " no program" and is like "an army without a plan of attack."[14] The Baikal-Amur Mainline Railroad (BAM) program is limping along, with only parts of it included in the current plan.[15] Similarly, the draft of the transportation program reportedly will not be ready before the end on the year, and the one on the use of chemicals not before mid-1983.[16]

Administrative restructuring.—In an effort to make the administrative hierarchy more effective in coordinating multisector programs, Soviet leaders are creating special commissions at the apex of the government to monitor target programs and to formalize leadership roles that cut across departmental boundaries. The authority of Gosplan in these target areas also has been strengthened by the creation of program-oriented departments and other internal changes that are to enable it to conduct more comprehensive planning and better policy analysis.[17] In February 1981 Brezhnev revealed that a commission on the West Siberian oil and gas complex had recently been formed under the USSR Council of Ministers Presidium and that a companion interagency regional commission (located in Tyumen) had been established under Gosplan. He called these actions "steps in the right direction" and emphasized that "this work must continue."[18]

In July 1981 another commission was set up under the Presidium for the conservation and rational use of resources, and by decision of the recent May plenum a similar commission has been created to oversee the national food program and the "agro-industrial complex."[19] All three commissions, headed by deputy premiers, are in effect "Mini-VPKs," and a similar approach is likely for other target programs.[20]

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[11] N. Baybakov, "Ekonomicheskaya strategiya KPSS na sovremennom etape," Partiynaya zhizn', 6 (1982), p. 25. The length of the priorities list has been a matter of some debate. The July 1979 party-government decree on planning specified five problem areas for target programing. The number of problems approved by Gosplan for target program status grew to 13 just prior to the October 1980 Central Committee plenum when Brezhnev added the "food problem" to the list. (See Voprosy ekonomiki, 10 (1980), P. 27). By about the time of the 26th Party Congress Gosplan had fixed the number of comprehensive target programs to be included in the Eleventh Plan at fifteen. (See the editorial, "General Course of the Economy," in Sovetskaya Rossiya, Mar. 2, 1981 and Sotsialisticheskaya industriya, Mar. 24, 1981). However, the battle over priorities continued as did bureaucratic lobbying to extend the program list. Writing in the July 1981 issue of Kommunist (p. 37), Academician Aganbegyan suggested that the total number of programs should be kept "within the range of 20 or so." At about the same time, a Gosplan official noted that "more than 15" national target programs would be formally incorporated into the macroeconomic plan Voprosy ekonomiki, 7 (1981), p. 15). Despite these signs of some jockeying over numbers, however, the figure "15" continues to be cited by Soviet sources and appears to be the general working number settled upon for the current plan.

[12] Pravda, Ma 28, 1982.

[13] Pravda, Nov. 17, 1981.

[14] Sovetskaya Rossiya, Dec 13, 1981.

[15] V. Mozhin, N. Singur, and Yu. Sobolev, "Tselevaya programma khozyaystvennogo osvoyeniya zony BAM," Planovoye kyozyaystvo, 2 (1982), pp. 18–19.

[16] Ekonomicheskaya gazeta, 16, (April 1982), p. 2 and Izvestiya, May 11, 1982.

[17] Kommunist, 10 (1981), p. 36; Voprosy ekonomiki, 3 (1982), p. 103; Izvestiya, May 11, 1982.

[18] Pravda, Feb. 24, 1981.

Similar restructuring is taking place in some republics where target programing approaches are gaining ground. The Ukraine, which has six republicwide target programs, has established coordinating commissions under the Council of Ministers for all of them, with a deputy premier personally in charge of each.[21] In Latvia, one central coordinating commission (led by a deputy chairman of the Council of Ministers) has been set up and oversees all 12 of the republic's priority programs.[22] An interdepartmental commission for resource conservation along the lines of the new body in Moscow is being created in all the union republics under a first deputy or deputy premier. Similarly, a presidium commission or counterpart body is being formed on the republic level under the Council of Ministers to oversee problems of the agro-industrial complex and implementation of the national food program.[23]

Georgian party boss Eduard Shevardnadze is advancing the administrative restructuring even further. As early as last year, he established a republic commission with himself as chairman to oversee preparation of the food program and, in late January of this year, a republic interdepartmental coordinating council under a deputy premier to administer the agro-industrial complex.[24] He describes these innovations as "a completely new stage in improving the forms and methods of managing not only the branches making up the agro-industrial complex *but also the entire economy and, if you like, even party and Soviet agencies.*" (emphasis added).[25] In another institutional departure, the Georgian Central Committee in mid-May decided to set up a republic coordinating council on science and technical progress that Shevardnadze also will head with other members of the republic party bureau (that is, the Georgian politburo) leading various working groups.[26]

Shevardnadze has even suggested that the efforts underway may be only a first step and possibly a backdoor approach to more general administrative reform. This might involve a future consolidation of the ministries and a reorganization of the party apparatus itself.[27]

THE PARTY'S ROLE IN TARGET PROGRAMING AND ECONOMIC MANAGEMENT

The political pressure for target programing and nascent administrative restructuring is coming from the party, not the government. Party organs are injecting themselves directly into target programing of priority problems because there are no appropriate government bodies that can effectively handle them. As a regional party first secretary explained in the September 1981 issue of Kommunist, "someone must take the initiative and assume responsibility." "By the logic of things," he added, "the party committee must act as such an organizing center." [28]

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[19] Pravda, July 4, 1981; Izvestiya, Oct. 3, 1981; Pravda, June 12, 1982.

[20] Aganbegyan and others have specifically called for a Commission to oversee the BAM program. (See Sovetskaya Rossiya, Dec. 13, 1981; Planovoye khozyaystvo, 11 (1981), 115–117 and 2 (1982), p. 26.) The establishment of a Council of Ministers Presidium Commission to monitor the mechanization of labor program has also been proposed. (See Kommunist, 7 (1982), p. 41.

[21] Pravda, June 16, 1981 and Izvestiya, July 10, 1981.

[22] A. Voss, "Shirokiye vozmozhnosti programmno-tselevogo planirovaniya." Kommunist, 15 (1981), pp. 27–28.

[23] Pravda, July 4, 1981 and May 28, 1982.

[24] Zarya Vostoka, Nov. 26, 1981 and Feb. 24, 1982.

[25] Zarya Vostoka, Jan. 20, 1982.

[26] Zarya Vostoka, June 5, 1982.

[27] See especially his remarks in Zarya Vostoka, Mar. 3 and 5, 1982.

At the same time, other officials and policy experts have begun to question whether the lack of state management bodies is causing party agencies to become overburdened with purely economic functions. They point out that this may divert party agencies from other political and social tasks that only they have the ability to manage.[29]

The increasing party intervention in economic management is providing new shape and momentum to the issues of administrative reform and party control and is being openly debated in the Politburo. Following Brezhnev's lead, several top party officials have spoken out in recent months on the party's strategic role in target programs. For example:

In a Pravda article in August 1981, Grigoriy Romanov noted that the Leningrad party oblast committee "unites and directs" all work in this area and stressed that each program "must come under strict party control." [30]

At recent republic plenums and in press articles Vladimir Shcherbitskiy and Shevardnadze have emphasized the supervisory responsibilities of republic and oblast party secretaries for priority problems as well as the need for government restructuring for more effective management of target programs.[31]

On the other hand, growing party involvement in economic decisionmaking has raised new charges of excessive party interference in economic management and has heightened the leadership debate over the party's role in the economy.[32] Within the Politburo, Andrey Kirilenko and Konstantin Chernenko appear to be the main antagonists on this issue. Kirilenko argued in Kommunist in August 1981 that the imperatives of technical progress require more integrated policies, more comprehensive program planning, and more active party intervention in modernizing the economy.[33] At two back-to-back party-government conferences on problems in the nuclear power industry in July 1981 and February 1982—sponsored by the Central Committee and presided over by Kirilenko—"stricter party control" was the recommended solution for improving the situation.[34]

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[28] F. Morgun, "Chuvstvo novogo," Kommunist, 13 (1981), p. 26. A Soviet legal scholar similarly notes that party agencies intervene because of institutional gaps in the system of state administration. He writes, "As a result party organs sometimes are forced, filling a vacuum in the system of the state apparatus, to act where the state should fulfill its functions but fails to do so because of the absence of structural bodies needed to do this." (See S. Ye. Zhilinskiy, "Funktsii KPSS i gosudarstva v politicheskoy sisteme: ikh sootnosheniye," Sovetskoye gosudarstvo i pravo, 4, (1980), 137–138.

[29] R. Leshchiner raises these issues explicitly in his letter to the editors of Kommunist in the September 1981 issue (pp. 111–114).

[30] "Po Kompleksnym programmam," Pravda, Aug. 4, 1981.

[31] For Shcherbitskiy's views, see his articles "Trebovatel'nost' i otvetstvennost'," Pravda, June 16, 1981; "Umnozhat' proizvoditel'nuyu silu nauki," Izvestiya, July 10, 1981; and "Kadrovaya politika: opyt i problemy," Kommunist 1 (1982), p. 48. For Shevardnadze, see Zarya Vostoka, Nov. 26, 1981 and Mar. 5, 1982.

[32] A March 1981 Kommunist article emphasized that the increased role of the Party in economic construction required the formulation of new criteria for separating party and economic management functions and organs. The author explicitly noted that "obviously" the dividing line here "cannot be based on individual targets or problems." (See V. Mazur, "Novyye rubezhi—novyye Zadachi i problemy," Kommunist, 5 (1981), 71–82).

[33] A. Kirilenko, "Edinaya tekhnicheskaya politika partii na sovremennom etape kommunisticheskogo stroitel'stva," Kommunist, 12 (1981), 3–16.

In the September 1981 issue of Kommunist, Chernenko accented the need for the party to address the social problems of the technological revolution and pressed for reducing its managerial role. Chernenko claimed that usurpation by party officials of economic management functions "only creates the appearance of strengthening the party's role and, in fact, often does much harm." He insisted that clearer delineation of functions, not substitution, is required "so that everyone knows his own lines." Citing Lenin, he also implied that a better distribution of functions was needed even at the Central Committee.[35] Chernenko repeated these points in February 1982 and again in April in articles in Voprosy istorii KPSS and Kommunist.[36]

Shcherbitskiy and Shevardnadze have been more equivocal. In general, they are "prointerventionist" and support tighter party control over priorities and the management bureaucracy, but they apparently believe these goals can be accomplished by forms of party intervention less direct than those Kirilenko advocates and by less direct control from central party organs. These two republic party leaders have even echoed the Chernenko line that usurpation of economic management functions by party officials leads inevitably to reduced managerial responsibility and effectiveness.[37] At republic party special plenums on science and technology in April and May of this year, however, they both, like Kirilenko, have insisted on the need for greater party intervention to break the barriers of bureaucratic and technological conservatism.[38]

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[34] Pravda, July 16, 1981 and Izvestiya, Feb. 6, 1982.

[35] K. Chernenko, "Leninskaya strategiya rukovodstva," Kommunist, 13 (1981), 6-22. As regards the party's role and party-government relations, Chernenko notes, "Life persuades us more and more that the problem of the correlation of party, economic, and state leadership is far from simple. We still face a strenuous search to formulate the optimum forms of resolving it." He then quotes Lenin's demand: "Differentiate much more precisely the functions of the party (and its Central Committee) and of Soviet power; enhance the responsibility and independence of Soviet workers and Soviet establishments, and leave the party with overall leadership of the work of all state organs together, without the current too frequent, irregular and frequently petty interference." Chernenko describes the relationship between party and state as "one of the central problems" of developed socialism and notes that at each stage of development "the CPSU seeks specific forms of dividing up and combining the tasks of the Soviets and of the party."

[36] K. Chernenko, "Vopros, vazhnyy dlya vsey partii," Voprosy istorii KPSS, 2 (1982), 3-19 and "Avangardnaya rol' partii kommunistov: vazhnoye usloviye yeye vozrastaniya," Kommunist, 6 (1982), 25-43. As regards target programing and party involvement, Chernenko asserts, "It is good that we have learned to compile comprehensive, targeted, longterm plans, and planning must continue to be improved." At the same time, however, he adds, "It is bad when individual party committees devote so much effort to compiling various plans that no time remains for their implementation. It is well known how venomously Lenin riduculed those who 'quite often give the most wonderful advice and guidelines but prove to be, to the point of riduculousness, to the point of absurdity . . . incapable of implementing this advice and these guidelines;" "Avangardnaya rol' partii," p. 35).

With respect to party officials taking on direct management responsibilities, Chernenko notes that "objective conditions during the first post-October decades sometimes did indeed dictate to the party worker or activist the need to get the bricks or nails and decide himself management issues directly." He argues, however, "circumstances have changed" and "if a party organizer now becomes a fixer, supplier, and adminstrator, this 'enthusiasm' of his is as a rule not only misplaced but also downright harmful." "Vopros, vazhnyy dlya vsey partii," p. 7.)

[37] See Shcherbitskiy, "Kadrovaya politika," p. 48 and Shevardnadze's remarks in Zarya Vostoka, Mar. 3 and June 18, 1982.

[38] See Shcherbitskiy's remarks in Pravda Ukrainy, Apr. 16, 1982 and Shevardnadze's in Zarya Vostoka, June 5, 1982.

The Central Committee plenum in November 1981 failed to resolve this issue. From his published remarks Brezhnev seems to have come down more on the side of the prointerventionists stressing, "We have a right to expect that party committees at all levels will enhance appreciably their influence on economic life." At the same time, he warned that influence was not to be equated with petty supervision or substitution for economic and administrative organs.[39] Pravda has repeated these themes in its postplenum editorials, along with the point that the drawing up of target programs "is within the power of any party organization."[40] The editors of Kommunist have similarly emphasized that the target programing approach has acquired "the force of a general party directive."[41]

IMPLICATIONS AND PROSPECTS

These measures represent yet another attempt by the Soviet leadership to give momentum to faltering economic reform efforts and to reassert the need for comprehensive solutions to critical problems. Because of the infancy of most target programs and of the new organizational structures set up to monitor them, their impact is uncertain. This approach to economic management, nonetheless, might have important implications for economic policy, political succession, party and governmental restructuring, military-civilian relations, and Soviet foreign policy and trade relations. Fundamentally, this approach to economic planning and management is politically unsettling for a broad array of Soviet bureaucratic elites because it threatens to undermine—and undo—basic organizational policies, institutional relationships, and operating principles that have regulated Soviet politics during much of the Brezhnev era. At the same time, the approach imposes increased demands on an already heavily burdened bureaucratic establishment.

ECONOMIC POLICY AND PLANNING

Special programs and greater party intrusion into economic decisionmaking are not likely to be effective in solving the economy's major long-term problems and chronic ills. These administrative approaches may even impede economic performance and may prove, particularly if implemented with force, to be new Khrushchev-style "harebrained schemes." In a June speech in Krasnoyarsk, Party Secretary Konstantin Chernenko implied that Brezhnev's food program already is meeting heavy behind-the-scenes criticism when he emphized that it was not a "wild, abstract, and ineffective" plan of action.[42] At the same time, Politburo member and Kazakh party boss Dinmukhamed Kunayev similarly denied there was anything "supernatural or impracticable" about the program.[43] In addition, the long list of target programs appears to be still tentative. The programs themselves promise to have a long gestation period, and their integration with overall economic plans promises to take much more time. Thus, they may prove to be "paper tigers" rather than viable ways of designing and managing the future.

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[39] Pravda, Nov. 17, 1981.

[40] Pravda, Dec. 16, 1981 and Jan. 4, 1982.

[41] Kommunist, 15 (1981), 15.

[42] Sovetskaya Rossiya, June 16, 1982.

[43] Kazakhstanskaya Pravda, June 24, 1982.

Because of the difficulties and delays besetting their formulation, the real impact of these target programs on Soviet decisionmaking, if any, is likely to be felt in the next five-year plan (1986–90) rather than in the current one.[44] In the interim, these programs no doubt are chewing up a sizable amount of bureaucratic manhours. In terms of the planning cycle, the key decisions and policy choices for the next plan will be taken in 1983 and 1984. By that time all the major programs should be well fleshed out, and they probably will weigh heavily in economic plan deliberations. As recently demonstrated by the food program, Brezhnev already is trying to use this policy planning tool to lock the leadership into a particular course of action and to guarantee the investment resources needed for its implementation, but whether this tactic will survive succession politics is problematic.

BUREAUCRATIC POLITICS AND LEADERSHIP SUCCESSION

Whatever their economic effect, however, the target programs are likely to have a great impact on bureaucratic infighting and succession maneuvering. Indeed the programs themselves are products of the Soviet political process and reflect the mindset of the ruling elite, its penchant for administrative approaches and strong bureaucratic aversion to radical structural reform. The programs create possibilities for new political alliances and interest groupings that crisscross sectoral, regional, and program lines. Already the term "program departmentalism"has surfaced, signaling a bureaucratic struggle at the top and competition for resources among rival program claimants. As overall responsibility for target programs is vested increasingly in the deputy chairmen of the Council of Ministers, friction could develop among them, as well as between the Council's Presidium and the more traditionally oriented ministries.

Even within the Politburo and Secretariat, some members' prestige and political fortunes will be increasingly wrapped up in the visibility and viability of target programs under their sectoral or territorial supervision. Brezhnev himself is personally associated most frequently with the energy, food, and consumer goods programs. Chernenko has identified himself closely with the food program while Mikhail Gorbachev, the Secretary for agriculture, will bear prime responsibility for its implementation. Vladimir Dolgikh, the Secretary for heavy industry and new candidate member of the Politburo, appears to have general oversight of the energy and conservation programs. Politburo candidate member and Russian Federation (RSFSR) Premier Mikhail Solomentsev would seem to have keen interest in the fate of the program for agricultural redevelopmet of the RSFSR's nonchernozem soil zone and the Siberian-based programs.

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[44] Academician V. Trapeznikov notes that the savings derived from the target programs will come in the 12th and 13th 5-year plans. See his article, "Upravleniye i nauchno-tekhnicheskiy progress," Pravda, May 7, 1982.

Even though the economy is likely to become a major issue in the impending leadership transition and the sheer dimensions of economic problems increase the probability of policy shifts, the political succession might have a dampening effect on the prospects for reform of economic management. The political uncertainty and risk created by the succession process are likely to constrain both the scope and pace of structural reform. Power politics, entrenched bureaucratic interests, and inertial systemic forces all would work against fundamental institutional change. No leader likely to succeed Brezhnev would have, initially at least, the power to push through a comprehensive package of domestic or foreign policy programs. Moreover, both the leading succession contenders at the moment—Chernenko and newly-appointed Secretary Yuriy Andropov—significantly lack experience in the economic area. In addition, because of the advanced age of the present ruling group, Brezhnev's replacement may be only an interim successor, and leadership turnover will probably accelerate in the coming years—a factor that will complicate further the problems of building a consensus on and commitment to management reform. Any major reform, thus, will probably have to await the emergence in the late 1980s of a somewhat younger group of Politburo members who might be more receptive to change and sensitive to deficiencies of the existing system. Major reform would likely require the consolidation of the new party leader's position, as well.

Meanwhile, Brezhnev's own intensified efforts in recent months to force administrative change and to try to prearrange the succession in Chernenko's favor have prompted political reaction and bureaucratic resistance that threaten to erode his own authority and to aggravate the succession struggle. As cited earlier, Soviet leadership statements, for example, indicate that differences have emerged over the food program, complicating its future and its managerial schemes. Different policy preferences and political dispositions are likely to become sharper, and maneuvering in the Politburo more intense in the coming months, as succession contenders are forced to outline more openly competing strategies for dealing with the economy's worsening performance.

ADMINISTRATIVE RESTRUCTURING AND ECONOMIC REFORM

These developments, moreover, appear to have shifted the debate on economic reform. Until recently, Soviet leaders sought to improve economic performance primarily through further centralization of planning and ostensibly strengthening "economic levers" (prices, credits, contracts) in decisionmaking. Bureaucratic restructuring and a greater role for "administrative levers" (cadre policy, direct instructions, discipline, penalties) were generally downplayed, partially in overreaction to Khrushchev's "excessive organizational itch" and arbitrary ways. Having restored the system of centralized branch ministries abolished by Khrushchev, the leadership adopted a conservative and cautious attitude toward structural change of economic management. Organizational policy assumed primarily an intrabranch rather than an interbranch focus, and the organizational preconditions for effective program planning and management were not laid.

More recently, however, Brezhnev, who unlike Khrushchev did not generally force radical organizational reforms on reluctant colleagues, has increasingly pushed the pace of administrative change along with the target program approach. At the October 1980 Central Committee plenum, where he first called for a special food program, he urged the Council of Ministers to conclude quickly its proposals for management improvement so that obsolete structures would not be carried over into the next five-year plan.[45] At the party congress in February 1981, he reminded the delegates that the economic structure with which the USSR will enter the 21st century had to be created in the 1980s, and he strongly endorsed the new Presidium Commission on West Siberia as a prototype for further restructuring efforts.[46] At the November 1981 plenum Brezhnev strongly criticized the "slow and halfhearted" implementation of the 1979 reforms and explicitly called for two special meetings of the Central Committee: one to break the bureaucratic logjam on the food program; another to air the whole question of organization and management. Both plenums, he noted, had Politburo approval.[47] The food plenum finally took place in May. His call for a special plenum on management improvement was repeated by the editors of Kommunist in March and apparently is "in the works."[48]

Seemingly more and more impulsive, testy, and determined to impose his organizational schemes, Brezhnev probably appears to his colleagues and the bureaucracy to be increasingly like Khrushchev in his final days. At the same time, his failing health, if not eroding political authority, probably strengthens doubts about his capacity to carry out his policy designs.

Increasingly, target programs are providing a vehicle for organizational change—albeit limited and ad hoc—in both the government and the party. Restructuring is assuming the form of special coordinating commissions or informal management bodies in both hierarchies rather than making any fundamental change in their formal administrative structures. Although this is likely to be a prolonged and piecemeal process, and any significant breakthroughs may not come until after the succession, the groundwork for institutional change is clearly being laid. At the same time, the programs and new coordinating organs can be seen as bureaucratic devices for limiting the scope of organizational change. They can create the appearance of leadership action and structural change while avoiding substantive modifications of the system of planning and management. In short, they may be used to finesse the problems of real administrative reform. How they are used and abused for political purposes will depend on the course of succession politics and on the extent to which the programs themselves become means of conducting the struggle for power by aspiring individuals and groups.

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[45] Pravda, Oct. 22, 1980.
[46] Pravda, Feb. 24, 1981.
[47] Pravda, Nov. 17, 1981.
[48] Kommunist, 5 (1982), p. 11.

Governmental reorganization.—Governmental restructuring has centered on efforts to give the Presidium of the Council of Ministers a more active role in management of the economic bureaucracy, and to enable it to function more effectively as an "Economic Bureau" and court of appeal in interdepartmental disputes, standing between Gosplan and the Politburo. The new commissions provide potentially important leverage points at the top of the administrative machinery where leadership views and political pressure can be brought to bear for purposes of improving problem solving and forcing interagency coordination in vital policy areas. Because Presidium commissions often function de facto as auxiliary agencies of the Politburo and—like the VPK—may be overseen directly by the Party Secretariat, these measures also appear aimed at strengthening the effectiveness of the Politburo itself and of the role of central Party organs in the making and management of economic policy.

Although this managerial approach is not new, changing political conditions and the continuing economic slowdown during the past two years have permitted intensified restructuring efforts. So long as Aleksey Kosygin was premier, the Council of Ministers successfully resisted the establishment of supraministerial coordinating bodies despite Brezhnev's repeated urgings.[49] Since Kosygin's departure at the end of 1980, however, his successor, Brezhnev's associate Nikolay Tikhonov, and a new team of deputy premiers—including some former party apparatchiki—have been seemingly more willing and able to press party-sponsored management schemes.[50] The three newly created Presidium commissions under the Council of Ministers, in fact, may be incipient forms of those specialized supraministerial organs called for by Brezhnev as early as the 1976 party congress and subsequently at almost every major leadership forum. The death of veteran party ideologue Mikhail Suslov in January 1982 also removed from the Politburo and Secretariat an important conservative and stabilizing force who generally opposed economic reform and institutional experimentation.

Party reform.—The target programing approach and structural changes under way in the governmental machinery raise the need for and prospect of controversial organizational and attitudinal adaptation in the party apparatus. Having undone Khrushchev's institutional innovations and restored the pre-1962 party structure, his successors have adopted as staunchly conservative a stance toward organizational experimentation in the party as they have in the government. Indeed, the formal party statutes have not been modified at all by the past two congresses, an absence of change unprecedented in Soviet party history. Party organization traditionally mirrors the governmental economic structure, however, and considerable pressure is likely to build to create special subdivisions oriented to priority problems that can monitor government management of target programs. Filling these organizational holes and realigning functional responsibilities is necessary if the party apparatus is to police effectively the newly evolving system of target programs and government coordinating bodies.

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[49] Interestingly, Kosygin noted in his remarks on the new law on the USSR Council of Ministers, adopted in July 1978, that questions dealing with major nationwide, interbranch, and territorial programs were occupying an increasingly larger portion of the activity of the Council. He also noted that a Presidium Commission on Current Economic Questions had recently been recreated apparently to handle this growing decision load. (See Pravda, July 6, 1978).

[50] Even before Kosygin's retirement, Tikhonov expressed strong support for the target programing approach and the requisite administrative restructuring for better coordination among ministries. (See his article, "Sovershenstvovaniye upravleniya kak vazhnyy rezerv", Kommunist, 7 (1979), 35-48.) Referring to the new Presidium Commission on the West Siberian Oil and Gas Complex, Tikhonov told the Twenty-Sixth Party Congress, "Apparently this is the path we should follow in drawing up and carrying out other interbranch and regional programs." (Pravda, Feb. 28, 1981).

Some movement already is being made in this direction. A few oblast party committees have begun to set up special offices or staffs to oversee key programs.[51] In line with the decisions of the May 1982 plenum, agricultural departments are being established in rural district party committees to monitor implementation of the food program and coordination within the agro-industrial complex. In general, the new managerial approach and increased accent on party control of economic administration suggest that a regrouping, and possibly expansion, of the party apparatus may be in the offing along with some organizational change.

The recent administrative innovations at the Council of Ministers bear directly on the assignment or responsibilites within the Politburo, the allocation of tasks and organization of work within the Secretariat, and the institutional relationships and operating procedures between central party organs and the highest levels of the Soviet Government. Although we do not know what kinds of ad hoc adjustments have been made with respect to these issues, the demands for organizational adaptation in the Party machinery seem increasingly compelling and cannot be put off for long. At the same time, whatever new structural designs are adopted, they will necessarily become wrapped up with larger political maneuvering and personal rivalries within the leadership in the struggle for Brezhnev's mantle.

MILITARY-CIVILIAN RELATIONS

On another level, this approach introduces a fundamentally new factor into military-civilian industrial relations. In the pest, the military did not have to contend with any civilian counterpart of the VPK or of defense priority programs. The creation of commissions under the Council of Ministers for certain civilian programs and their endowment with broad monitoring and coordinating responsibilities like those of the VPK is a new wrinkle. Although they have the same formal status organizationally as the VPK, however, these commissions are still largely experimental, untried, and distrusted structures with ill-defined powers and an uncertain future. Until they gain real authority and legitimacy through the experience of their usefulness, their effectiveness in overseeing their own programs remains problematic—even more problematic is their ability to challenge the VPK or to extend their bureaucratic sway over the operations of the defense industry.

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[51] A party secretary of the Rostov obkom has recently argued that the system of creating a special party staff to oversee each program "fully justifies itself." (Ekonomicheskaya gazeta, 7 (1982), p. 5.) In Voroshilov province in the Ukraine a council has been created in the construction department of the obkom to supervise the development of a target program to reduce manual labor. (Ekonomika stroitel'stva, 5 (1981), 40–42.).

Whether these new bureaucratic structures and target programs become merely minor irritants or major constraints on the military-industrial establishment remains to be seen. At the recent May plenum, Brezhnev seemed to make special assurances to the military that the food program would not adversely affect defense programs and national security.[52] Yet, to the extent the new approaches help the Soviets gain a better hold on their critical civil sector problems, they may affect, if not alter, the balance between defense and civilian priorities and the ability of military program managers to carry out their missions. Civilian target programs may begin to compete with defense projects for increasingly scarce resources and leadership attention, and the Soviet decisionmaking machinery for priority problems may become increasingly strained and overloaded. This competition is likely to be indirect rather than explicit, however. By trying to stretch the priority principle to cover critical civil sector problems, Soviet leaders will necessarily reduce the resource slack in the system and the size of the residual for nonpriority activities. The battle over priorities will grow more intense, but the main struggle will not be between major military and civilian programs but is more likely to take place within the civil sector. The real losers in this new game probably will be those civilian projects that fail to win priority status. At the same time, it is possible that these projects might include some organizations that are third or fourth order suppliers or producers for the military; consequently some defense programs might be adversely affected by the new approaches.

As yet, there is little evidence on how the Soviet defense establishment actually stands on the new planning and management approaches being used in the civilian sphere. Articles in the military press sometimes depict target programs as having "strategic" or "security" significance, suggesting high-level support, particularly for those programs oriented to critical sectors like machine building, metallurgy, and the fuel and energy complex.[53] Here the armed forces themselves have a strong vested interest in improving Soviet economic performance and expanding production and innovation capacity. Military opinion probably also favors gradual upgrading of the traditionally neglected civilian industries that will provide broad, infrastructural support for new weapon systems. Recent statements in the Soviet press by high-ranking officers, including Defense Minister Dmitri Ustinov and particularly General Staff Chief Nikolai Ogarkov, reflect keen sensitivity to the prospects and implications of intensified economic warfare with Washington and, accordingly, to the need to overcome existing vulnerabilities and weaknesses.[54] Similarly, the military high command probably is not totally impervious to arguments that improvements in social conditions, consumer welfare, and the overall health of the economy will ultimately impact on Soviet defense capabilities in the broadest sense.

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[52] Pravda, May 25, 1982.

[53] See, for example, A. Gurov, "Ekonomicheskaya osnova mogushchestva Rodiny," Kommunist Vooruzhennykh Sil, 7 (1981): 18–25 and the discussion by A. I. Pozharov, Ekonomicheskiye osnovy oboronnogo mogushchestva sotsialisticheskogo gosudarstva (Moscow, 1981), pp. 93–100, 105–108, 113–141.

[54] Marshal Ogarkov's views are found in his article, "Na strazhe mirnogo truda," Kommunist, 10 (1981), 80–91 and his pamphlet, Vsegda v gotovnosti k zashchite otechestva (Moscow, 1982). For Ustinov's views, see his articles in Pravda, Nov. 7, 1981 and July 12, 1982 as well as his pamphlet, Sluzhim Rodine Delu Kommunizma (Moscow, 1982).

At the same time, the new management approaches probably instill apprehension and possibly even opposition in certain military circles. The formerly unique position of the VPK and the absence of civil economic counterparts at the apex of the governmental structure reflected clearly the institutionalization and legitimation of the priority of military over civilian needs.[55] Some members of the military and political elites may fear that the recent institutional changes could result in a loss of status for the VPK as well as potential competition with and encroachment from the new civilian coordinating bodies. Presumably, segments in the military would also strongly resist any reordering of priorities in resource allocation and the development of civilian target programs at the expense of not only existing defense programs but of a sustained military buildup to counter American rearmament and new technological systems.

At present, the military establishment may be concerned that the target programs could take on broader dimensions during the succession. Should the succession shape up so as to give rise to a more open debate over investment policy, the target programs might get caught up in the struggle for power and disputes over resource allocation. Should they become vehicles for conducting succession politics, the programs might come into more explicit conflict with the defense establishment. The particular way the target programs and new coordinating structures evolve may also give some signs about the state and direction of the allocation debate and the broader tradeoffs between defense, economic growth, and consumption.

FOREIGN DIMENSIONS

Although the target programs for the 1980s deal generally with Soviet domestic development priorities, they contain important aspects that bear directly on trade policy and more broadly on foreign policy. The list of target programs was initially compiled during the imposition of Western economic sanctions against the USSR in reaction to the Soviet invasion of Afghanistan and the declaration of martial law in Poland. One of the original programs singled out for this new priority status reportedly focused on the development of certain scarce but unspecified strategic goods that had been major import items in the past—reflecting leadership concern over Soviet vulnerability and dependence exposed by the sanctions.[56] The leadership's sensitivity and desire to protect itself from trade bans and technology embargoes seems to have become a common thread through the target programs as a whole.

Brezhnev hammered on this central theme at the May plenum on the food program. He cited the growing dependence of the USSR on food imports as "a major strategic concern," and he emphasized that a key aim of the target program was to restrict food imports from capitalist countries in order to "guarantee against all eventualities." With the U.S. grain embargo in mind, Brezhnev declared, "The country cannot depend on the whims of Western leaders who are trying to use international economic relations as a means of political pressure." And he added with emphasis, "We have never put up with this, nor are we going to." [57] Although the prospects for cutting grain imports substantially and gaining self-sufficiency in food resources in this decade are not at all realistic, heightened leadership concern over the vulnerability-dependency issue is quite real.

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[55] On this point, see Becker, "The Burden of Soviet Defense," pp. 50–55.

[56] See V. Ivanchenko, "Sovershenstvovaniye planovogo rukovodstva ekonomikoy," Voprosy ekonomiki, 10 (1980); 128. Prof. B. P. Plyshevskiy also includes this particular program among the 15 target programs in his study, Effektivnost' obshchestvennogo proizvodstva: puti Povysheniya (Moscow, 1981), p. 62.

Alongside the theme of reducing Soviet dependence on Western states, increased stress is given to greater reliance on cooperation with socialist countries, and to integrating the target programs more closely with the economic strategy for the 1980s of the Soviet-led Council for Mutual Economic Assistance (CEMA). Premier Tikhonov sounded this line in June at the annual conference of CEMA country premiers in Budapest by soliciting member participation in the Soviet food program and calling for tighter bloc cohesion to counter Western policies of economic warfare.[58] The coming months are likely to see increased Soviet pressure on the member states to cooperate in common critical areas. In particular, there is likely to be even greater dovetailing and overlap of Soviet target programs with the five long-term CEMA cooperative target programs (energy, fuel and raw materials, machine building, foodstuffs, industrial consumer goods, and transportation), adopted at the end of the 1970s.[59]

On another level, the target programs reflect the Soviets' apparently enhanced willingness to consider the relevance of aspects of East European economic experience to their own current and long-term policy concerns. The food program in particular draws explicitly upon Hungarian and Bulgarian agricultural practices.[60] More broadly, however, a special commission has been created recently under the Presidium of the USSR Council of Ministers (headed by deputy premier and Gosplan Chairman Baybakov) to study the applicability of East European economic systems to the USSR and to see if there are any lessons that might offer some answers for its troubled economy.[61] The target programs provide a possible vehicle for transferring selected aspects of East European economic reforms to Soviet soil, a dimension that Soviet economic reformers are increasingly likely to play up.

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[57] Pravda, May 25, 1982.

[58] See Izvestiya editorial, June 3, 1982; Krasnaya zvezda, June 12, 1982 and the editorial in Pravda, June 19, 1982 and June 9, 1982. The final, ninth section of the Food Program envisages a further deepening of the USSR's cooperation with socialist countries in the sphere of agricultural production and the processing and rational utilization of raw materials. See Prodovol'stvennaya programma SSSR na period do 1990 goda i mery po yeye realizatsii: Materialy Mayskogo plenuma TsK KPSS 1982 goda (Moscow: Izdatel'stvo "Krasnaya Zvezda," 1982), pp. 50–51.

[59] See K. Mikul'skiy, "Soglasovaniye ekonomicheskoy politiki—nazrevshaya potrebnost' sotsialisticheskogo sodruzhestva," Mirovaya ekonomika i mezhdunarodnyye otnosheniya, 12 (1981), 42–53; V. Grinev, "Sovershenstvovaniye upravleniya vneshneekonomicheskimi svyazami SSSR so stranami SEV," Voprosy ekonomiki, 8 (1981), 108–114; and the editorial, "Sozidatel'naya moshch' kollektivnogo opyta," Kommunist, 5 (1982), pp. 11–13.

[60] See I. N. Buzdalov and M. Ye. Bukh, "Khozyaystvennyy mekhanizm agropromyshlennoy sfery," Voprosy ekonomiki, 3 (1982), 96–104. See also the series of articles on the Hungarian Economic Model in Literaturnaya gazeta, Sept. 30, 1981 and Mar. 13 and 17, 1982.

[61] On this commission, see the editorial, "Sozidatel'naya moshch' kollektivnogo opyta," Kommunist, 5 (1982), p. 11 and the remarks by CPSU Secretary K. V. Rusakov in E. M. Tyazhel'nikov, ed., Za vysokoye kachestvo i dlystvennost' ideologicheskoy raboty (Moscow, 1982), pp. 237–238.

SOVIET ECONOMIC "REFORM" DECREES: MORE STEPS ON THE TREADMILL

By Gertrude E. Schroeder*

CONTENTS

Page
Summary 65
- I. Introduction 66
- II. Limiting demand for labor 68
  - A. Labor balances 68
  - B. Incentives for economizing on labor usage 69
  - C. Manpower ceilings and other measures 70
- III. Economizing on use of materials and energy 70
  - A. Planning norms 71
  - B. Resource-saving plan targets 71
  - C. Shift to net output targets 72
  - D. Revised physical plan indicators 73
  - E. Prices 73
- IV. Improving planning, management and general economic efficiency 73
  - A. Upgrading product quality 73
  - B. Improving the functioning of the wholesale distribution system 75
  - C. Revision of industrial wholesale prices 76
  - D. Strengthened financial "levers" 77
  - E. Planning approaches and technologies 79
  - F. Changes in organizational structures 81
- V. Evaluation of the new working arrangements 82
  - A. In the right direction? 82
    - 1. Increased centralization 82
    - 2. New planning contradictions 82
    - 3. Fettering the production unit 84
  - B. Impact on management of human and material resources 86

SUMMARY

In July 1979 the Soviet leadership promulgated with great fanfare a decree providing a spate of new measures to improve planning and performance of the economy. This decree, together with its more than 80 implementing regulations and a July 1981 amendment, is no more likely than its predecessor of October 1965 to contribute much to raising the economy's efficiency. Indeed, by adding to the burden on the central bureaucracy and by preempting scarce managerial time to cope with the complex new arrangements, the latest round of "reforms" may make matters worse.

The principal goals and features of the new arrangements are as follows:

To improve planning by focusing on five-year plans rather than annual plans and on integrated planning of a few large, "comprehensive" programs. Plans are to be "balanced" (in

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terms of input-output relationships) and are to remain stable for a five-year period.

To align prices with costs by introducing new industrial wholesale prices on 1 January 1982, establishing a new charge for water usage and sharply raising social insurance taxes.

To replace a major success criterion—the notorious "val," which leads enterprises to prefer expensive inputs—with another indicator, "normative net output" (average value added).

To tie enterprise and worker incentives to a variety of five-year plan targets, measured in physical units as well as in rubles and focused on raising efficiency and product quality.

To increase responsibility at all levels by requiring ministries and ultimately enterprises to finance their operations from internal funds and bank credits, rather than partially from the state budget.

To make the investment process more effective by stipulating that approved plans remain unchanged for the five-year period, that all plans be backed with the requisite material and financial resources, and that bank credits rather than customers' funds by used to finance construction in progress.

In no sense do the multitudinous changes in working arrangements now en train constitute a genuine reform of the economic system. Rather, they reinforce its traditional features that have produced waste of resources on a grand scale. Planning is now more centralized, rigid and detailed than ever before: despite rhetoric to the contrary, the producing unit is more fettered: producer goods are more tightly rationed: administratively set, average cost-based prices are retained: incentive systems of Byzantine complexity tie rewards and punishments to meeting plan targets expressed in physical units. The large grab bag of modifications set in motion during the past three years is no panacea for the ills of the Soviet economy. Rather, they move the system in a way opposite from what most Western (and some Soviet) observers agree is needed—decentralization, flexibility, and introduction of market elements.

I. INTRODUCTION

Over three years ago, in July 1979, the CPSU and the Council of Ministers adopted the omnibus Decree No. 695 setting forth a wide range of measures to improve planning and the performance of the economy. This decree represents the second major attempt of the Brezhnev leadership to deal comprehensively with the chronic ills of the so-called economic mechanism.[1] The first attempt was embodied in the set of measures launched in October 1965—usually referred to as the Kosygin reforms. As implemented, those measures (1) restored the traditional system under which sectoral ministries manage economic activity, (2) carried out a major revision of industrial prices, centralizing their administration in a newly formed agency—the State Committee for Prices, (3) attempted to centralize the rationing of producer goods in a new agency—the State Committee for Material-Technical Supply (Gossnab), (4) raised the operational role of the five-year plan, now to be based on detailed long-range scientific and technical forecasts, (5) instituted a new system of incentives for enterprises focused largely on sales and profitability (return on capital), and (6) gave enterprises a little more freedom in managing labor and investment. These measures, having failed to produce the desired results, were modified several times over the next decade. Indicators of product quality and labor productivity were added to the list of determinants of managerial rewards, and incentives were supposedly linked to fulfilling contractual obligations. On the planning front the five-year plan was made legally binding at the same time that a system of counter-planning was introduced. In the process, several economic experiments were offically endorsed, all designed to uncover so-called hidden reserves and to remove one or another aberration prevalent under existing arrangements.[8]

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[1] For a detailed discussion of the 1965 economic reforms and the many modifications made during 1970 to 1978 see Problems of Communism, July-August 1971, pp. 36–46, Gertrude E. Schroeder, "Soviet Economic Reforms at an Impasse."; Joint Economic Committee, Soviet Economic Prospects for the Seventies, Washington, D.C., 1973, pp. 11–28, "Recent Developments in Soviet Planning and Incentives"; NFAC Research Paper ER 77-10769, December 1977, Organization and Management in the Soviet Economy; Joint Economic Committee, Soviet Economy in a Time of Change, Vol. I, Washington, D.C., 1979, pp. 312–340, "The Soviet Economy on a Treadmill of Reforms."

The July 1979 Decree:

(1) Reinforced the shift of the focus of planning and incentives from annual plans to five-year plans, which are to be balanced and to remain stable.

(2) Authorized the major industrial price reform of 1 January 1982.

(3) Revised the system of plan indicators and incentives to emphasize targets based on net output rather than gross output.

(4) Upgraded the role of so-called comprehensive or program-goal approaches to planning and management of economic activity.

(5) Outlined a program for gradual transfer of all economic entities to complete self-finance, beginning with industrial ministries.

(6) Aimed to make the investment process more effective by requiring that approved plans backed with requisite material and financial resources remain unchanged for a 5-year period and that bank credits rather than customers' funds be used to finance construction in progress.

(7) Detailed a number of other measures aimed at solving particular problems or removing particular sources of inefficiency.

The 1979 Decree and subsequent implementing regulations have set the planning and incentive arrangements that, unless subsequently modified, are to prevail during the rest of the 1981–85 plan and beyond. They are intended to enable the USSR to cope with declining productivity growth rates and growing resource constraints of unprecedented severity. Factor productivity declined during the 1970s. Throughout the 1980s, the growth of the labor force will be only half that in the 1970s. Production of critical materials—fuels, minerals, steel and lumber—has slowed considerably, and costs are rising sharply. Agricultural output has nearly stagnated, and costs per unit of output are also rising. Growth of the capital stock has slowed, and the return on investment has declined steadily. Thus, the USSR must substantially raise the return on resource inputs if economic growth is to continue even at modest rates. Equally urgent is the need to radically improve the quality of output and remove distortions in product mix that reduce the contribution of production to the economy. Soviet planners perceive these problems in all their severity. In addition to reducing growth targets, shifting investment priorities, and introducing policies to augment growth of the labor force, they are counting on the latest modifications in the working arrangements of the production system as spelled out in the July 1979 Decree. The Decree has engendered a burst of bureaucratic activity that has produced over 80 follow-up instructions. Already, the Decree has been amended by another major party-government decree (published in July 1981) dealing with measures to elicit savings in energy and raw materials.

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[8] The text of Decree No. 695 is given in Sobraniye postanovlenniy pravitel'stva SSSR, No. 18, 1979, pp 390–431.

This paper first describes the new working arrangements now being introduced, focusing, in turn, on (1) measures to limit the demand for labor, (2) measures targeted at obtaining large economies in use of raw materials and energy, and (3) more general provisions designed to obtain more utility in terms of desired, efficient final output from combined inputs of labor, capital, and raw materials. A final section evaluates the new arrangements and assesses their likely effect on the performance of the economy.

II. Limiting Demand for Labor

Soviet planners are convinced, correctly, that successful management of the quasi-market for labor in the 1980s requires severe restrictions on the demand for labor because there is little scope for augmenting supply beyond the small additions resulting from growth of the working-age population. Demand must be limited to supply, both nationally and locally, in order to keep growth of money incomes in line with slower growth of goods and services. The effort to limit demand for labor in individual enterprises also is part of the effort to raise labor productivity, especially by reducing gross overmanning. Some new measures are directed specifically at balancing supply and demand, especially in local and regional markets; others are aimed at reducing demand for workers in individual firms, both by fiat and through targeted investment and incentives. Both types are to be carried out in an economic environment featuring reduced growth of investment and serious efforts to restrict building new enterprises, which have larger staffing requirements than an equivalent capacity achieved by expanding and modernizing existing plants.

A. LABOR BALANCES

Not only will total labor force growth be slow in the 1980s, but rates of growth will differ widely among republics and administrative subdivisions. To provide a framework for assessing the critical regional dimension of the problem as well as the possibilities of coping with it, both five-year and annual balances of labor supply and requirements are now to be compiled for republics, krays, oblasts, rayons, and major cities. These balances are to be disaggregated by sex, sector, and skill level. Gosplan is required to submit balances for the USSR and the republics to the Council of Ministers for approval. The State Committee on Labor and Social Problems is supposed to play a much larger role in this planning process, as are regional planning committees and local soviets. The central authorities ordered all enterprises, beginning in 1980, to submit their planned requirements for manpower to local soviets for review prior to sending the plans forward to ministries.[3] Also, ministries were ordered to supply subordinate enterprises with labor mainly from local sources and through intra-ministerial redistribution, rather than through centralized distribution. Finally a major party-government decree of March 1981,[4] codifying some of these arrangements, ordered enterprises, regardless of subordination, to present their entire annual plans to local soviets, which are to review all matters concerning manpower and to confirm changes that affect labor requirements. The press reports a great deal of local activity related to labor planning. In the comprehensive plans for development of Leningrad and Moscow, for example, there are separate sections for labor; local authorities claim considerable success in restricting the growth of the labor force in their regions.[5]

In determining manpower needs at all levels, planning authorities are to be guided by tightened norms (planning factors) relating number of production workers to output and by leaner staffing patterns for white collar employees. This requirement, specified in the July Decree as implemented in a Gosplan instruction,[6] calls for a review of the entire system of norms used to determine labor requirements in industry to make them more "progressive", that is, tighter. "Progressive" norms are also to be employed both in calculation of the planned wage fund, which is to be set on the basis of norms relating average wages to output, and in establishing the wage components of the values of net output for industrial products promulgated in January 1982 along with the new wholesale prices.

B. INCENTIVES FOR ECONOMIZING ON LABOR USAGE

The new arrangements, like their immediate predecessors, make success in meeting labor productivity targets an important determinant of the size of economic incentive funds and managerial bonuses. Other new planning features are intended to reinforce this generalized incentive to save labor. The new rules require that the wage fund be determined on the basis of stable coefficients relating wages to output (wages per ruble of output[7]). Savings in the wage fund beyond planned amounts are to go into enterprise incentive funds. This procedure, a labor-saving experiment adopted in over

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[3] Ekonomicheskaya gazeta, No. 4, 1981, p. 10.

[4] Izvestiya, Mar. 29, 1981.

[5] The following are typical of the discussion of these matters: Sotsialisticheskiy trud, No. 9, 1980, pp. 80–93. Ibid, No. 5, 1981, pp. 30–39. Ekonomicheskaya gazeta, No. 4, January 1981, p. 10, and No. 43, October 1981, p. 10; Voprcsy ekonomiki, No. 10, 1981, pp. 73–80.

[6] Ekonomicheskaya gazeta, No. 10, March 1980, pp. 11–14.

[7] The instructions for calculating normative wages per unit of output are given in Ibid., No. 45, November 1979, p. 6.

2,000 enterprises, in effect carries on the 1967 Shchekino experiment (an effort to meet production plans with fewer workers at the Shchekino chemical plant).[8] Normative wage planning is scheduled to be introduced in 18 ministries in 1981 and in the remainder by 1983.[9] As under the Shchekino plan, enterprise managers are allowed to use wage savings to pay bonuses (up to 50 percent of regular wages) to workers who take on two jobs or similarly raise productivity. The new rules continue to penalize managers for wage overexpenditures, by charging them to the enterprise bonus fund and reducing managerial bonuses in the period in which the overexpenditure occurred.

C. MANPOWER CEILINGS AND OTHER MEASURES

The new arrangements contain other stringent requirements. First, beginning in 1980, ceilings on the number of employees were imposed on ministries and on enterprises.[10] Although the implementing instructions seemed to apply everywhere, evidently they were enforced only in industry. The industrial labor plan was only slightly exceeded in 1980, but there were complaints about failure on the part of many enterprises and ministries to observe the ceilings.[11] In late 1981, the Council of Ministers adopted a decree stating that beginning in 1982 annual plans will set an employment ceiling for all ministries, departments and union republics.[12] The decree also specifies sectors in which employment growth rates are to be reduced and those in which employment levels are actually to be cut.

Second, the price of labor is being raised beginning in 1982 because of a large rise in the social insurance charge. Third, the 1981-85 plan adds a new target to enterprise plans—a reduced number of manual workers in the total of production workers. Under the bonus statute, the ministry can make that target a determinant of the size of managerial bonuses. The idea is to substitute machines for men, freeing them for work elsewhere; thus, the instructions for implementing the new target require enterprises to submit lists of released surplus manual workers and their qualifications to local manpower offices for assignment.[13] Finally, workers are to be organized into brigades, mobilizing group pressures to meet production and productivity goals, with reinforcement provided by group bonus schemes.

III. ECONOMIZING ON USE OF MATERIALS AND ENERGY

The new working arrangements attack this objective on several fronts: (1) stiffer plan norms governing material usage; (2) establishment of material usage and cost-reduction targets for enterprises, with incentives tied to meeting those targets; (3) adoption of net output, rather than gross output or sales, as the principal measure of the value of production; (4) revised methods of measuring output in physical units; and (5) price changes.

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[8] Ekonomicheskaya gazeta, No. 3, January 1982, p. 6.

[9] Voprosy ekonomiki, No. 3, 1981, p. 140.

[10] Sovershenstvovaniye khozyaystvennogo mekhanizma: sbornik dokumentov, Moscow, 1980, pp. 83-84.

[11] Voprosy ekonomiki, No. 3, 1981, pp. 136-137.

[12] Izvestiya, Nov. 24, 1981.

[13] Ekonomicheskaya gazeta, No. 16, April 1980, p. 6.

A. PLANNING NORMS

The normative base for planning and allocating raw materials and energy is being revised to enforce large reductions in materials consumption per unit of product. Guidance for this vast effort at norm revision and extension was provided in the Gosplan document of January 11, 1980.[14] The system is to include norms relating to labor, materials, investment, and finances. Although a 1981 article criticized ministerial and other lower level planning and research agencies for the slow pace of work in revising norms,[15] stiffer ones were incorporated into the 1981–85 plan.

B. RESOURCE-SAVING PLAN TARGETS FOR ENTERPRISES

In the 1976–80 plan, Gosplan set annual targets for reduction in usage per unit of output for 39 major raw materials. These targets were established centrally in enterprise plans, but evidently were not well enforced, and in most cases incentives were not tied directly to their fulfillment. In the July 1979 Decree, targets for reduction in materials usage are among the plan targets for enterprises designated as "centrally established." Specification of incentives for enforcing those targets was left up to ministries.

A major CPSU-Council of Ministers decree, published in July 1981,[16] changes these arrangements substantially. The main provisions of the new decree are:

> Gosplan and other responsible agencies are directed to expand the list of materials for which usage-reduction targets are set and, beginning in 1982, to establish specific materials consumption norms for especially large materials users.
>
> In industry, construction and transportation, beginning in 1983, cost targets are to be fixed centrally and are to include explicit limits on material expenditures expressed in rubles per unit of product.
>
> Beginning in 1983, enterprises will be allowed to transfer to their incentive funds any monies saved by reducing material expenditures below the assigned limit; conversely, exceeding that limit requires reductions in the funds of as much as 25 percent of their originally planned amount. In addition, beginning in 1982 and 1983, enterprise employees are to be given bonuses related to the material savings achieved compared with the limits set.
>
> Starting in 1982, additional groups of workers are to be paid bonuses for reducing material expenditures below those set in the new "progressive" norms.
>
> Responsible agencies are to review existing standards for products and services to reduce their materials-intensiveness, and penalties for violating standards will be stiffer. Special ar-

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[14] Ibid., No. 10, 1980, pp. 11–14.

[15] Planovoye khozyaystvo, No. 8, 1981, pp. 31–32.

[16] Izvestiya, July 4, 1981.

rangements for economizing on the use of scrap metals were instituted in a decree on the subject issued in May 1980.[17]

C. SHIFT TO NET OUTPUT TARGETS

For decades, both Western and Soviet economists have pointed out the economic damage resulting from the use of gross value measures of output (GVO) to evaluate performance of enterprises. In the 1970s, numerous experiments were conducted to test the use of the net output measure defined in various ways. The July 1979 Decree orders the change to the use of this measure, wherever it is appropriate. (However, gross value measure and value of sales must still be calculated and reported). In general, net output is defined as gross output less purchased materials and depreciation and is equivalent to the sum of wages and profits, or value added. The transition to the net output indicator is to be made gradually, ministry by ministry; such targets were fixed in the plans of four ministries in 1981, with the rest scheduled to adopt the new measure in 1982 and 1983.[18]

The primary purpose of the adoption of net output to measure plan fulfillment is to eliminate the revealed preference of managers for producing material-intensive output; the weightier and more expensive the inputs, the higher was the value of total output and the easier it was to meet the plan. With plan fulfillment evaluated by net output, the argument goes, enterprises no longer will have an incentive to favor material-intensive products, or in the case of machinery to goldplate them. If they do so, cost will increase and profits, a major element of the net output, will be reduced.

Net output values (rather than gross values as before) are now to figure in evaluation of plan fulfillment with respect to output, labor productivity, and value of products in the highest quality category—the three major determinants of bonus funds. For a given enterprise, the total output will be determined, as now with respect to gross output, by summing net output values for all products, with the net output value for each one calculated as the product of the quantity produced and the normative net output value fixed for that product. Thus, normative net output for a given product is a species of price. The values were fixed by the State Committee for Prices and issued to enterprises simultaneously with the new wholesale price lists that took effect on 1 January 1982. A normative net output value is calculated for each product as the average branch-wide value added for the product. Specifically, it is calculated as the sum of wages of industrial-production personnel, social insurance charges and profits, expressed per unit of output. Thus, normative net output values are fixed in accordance with the principles used for setting producer prices in general. It should be noted, though that the profit rates used in setting net output values are expressed as percentages of cost (sebestoimost') after deducting average material expenditures included in the wholesale price for the product.

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[17] Ibid., March 8, 1981.

[18] Ekonomicheskays gazeta, No. 12, March 1981, p.4.

D. REVISED PHYSICAL PLAN INDICATORS

The July 1979 Decree instructed Gosplan to review the physical measures of production that (a) figure importantly in compiling material balances in planning, (b) are a key component in enterprise production plans, and (c) determine a manager's right to be paid bonuses. Gosplan was directed to find ways of incorporating into physical measure of output such factors as utility, quality and technical progressiveness. The aim was to remove the distortions and reduce the gross wastes created by measuring output simply in tons, meters, or number of units. Gosplan has announced that new physical indicators (unspecified) have been developed for 15 kinds of materials handling equipment, and "improved" measures for 70 kinds of machinery.[19] Having found no way to avoid planning ferrous metallurgical products in tons, Gosplan has now determined that "dual indicators" are to be used for that sector and for some kinds of machinery. The indicators in the case of steel pipe are tons and linear meters. Just how this dual system of indicators is supposed to work in practice is not clear, (that is, which one shall have precedence in determining whether plans have been net).

E. PRICES

Although relatively few details of the new prices that took effect in January 1982 have been released yet, those for fuels, electricity, and other raw materials are scheduled to increase substantially. Coal and natural gas prices are to rise by 42 to 50 percent and oil prices by even more. Substantial increase have also been indicated for electricity, ferrous metals (20 percent), nonferrous metals (14 percent), and commercial lumber (40 percent).[20] In contrast, prices of many kinds of machinery and chemical products are scheduled to decrease. Aside from brinigng prices into line with production costs, higher prices for energy and raw materials, coupled with revisions in incentive arrangements, are intended to promote conservation in general.

IV. IMPROVING PLANNING, MANAGEMENT AND GENERAL ECONOMIC EFFICIENCY

This section considers an array of innovations not specifically directed at obtaining savings in labor or raw materials, but rather intended to improve the functioning of the economy in general, including, of course, efficiency in its use of those specific resources. We group the many changes under the following rubrics: (1) upgrading product quality, (2) improving the wholesale distribution system, (3) revision of wholesale prices, (4) strengthened financial "levers," (5) changes in planning approaches and technologies, and (6) changes in organizational structures.

A. UPGRADING PRODUCT QUALITY

In general, the changes in working arrangements stemming from the July 1979 Decree strengthen ongoing approaches. Thus, meeting plans for raising the share of output classified in the highest (H) quality category in total production, now to be assessed on the basis of net rather then gross output,[21] continues to be a generally mandatory indicator for forming incentive funds and for determining managerial bonuses. Price markups for products awarded the State Seal of Quality are increased substantially and the duration of the markup lengthened.[22] Producer goods in the highest quality category may be priced with profit markups 50 to 125 percent higher than normally allowable rates. Profits from sales of goods with these price markups are allocated as follows: 70 percent to enterprise incentive funds, 15 percent to the ministry's central fund for financing research and development, and 15 percent to the state budget. Price rebates are imposed on production of goods in the lowest quality category (II) and on sales of output not certified as to quality on schedule: profits from such sales are confiscated in whole or in large part by the budget.

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[19] Voprosy ekonomiki, No. 10, 1980, p. 133.
[20] Planovoye kozyaystvo, No. 11, 1981, p. 29.

The procedures for state certification of the quality of industrial products are codified and strengthened by a Council of Ministers Decree issued in December 1979 and a follow-up Gosplan instruction of June 1980.[23] All industrial products other than specifically excepted categories are to be submitted for quality certification to state certification commissions. Commissions are set up for individual products or groups of products as appropriate. The membership of a commission consists of representatives of the producing ministry (but not the enterprise producing the product), the ministry of the principal consumer of the product, the ministry designated as "head ministry" for making the product, the State Committee for Standards (Gosstandart), and, if appropriate, the State Committee for Construction (Gosstroy), the Ministry of Foreign Trade, the Ministry of Domestic Trade, or a republic Ministry of Services for the Population. The commission must be chaired by a representative of the consumer ministry, Gosstandart or Gosstroy, and he must endorse any quality certification that is to be valid. In each case, the commission issues a certificate of quality, which is formally registered with Gosstandart and specifies the time limit on the validity of the certificate (1 to 3 years); it also recommends to the producing ministries whether a product certified in the lowest product category (II) should be modernized or dropped from production. Enterprise annual plans specify schedules for submitting products for certification. When products are produced in violation of standards, sales of that output are not counted in the value of production for plan fulfillment evaluation, and enterprise incentive funds are reduced as a further penalty.

Finally, the government continues to push adoption of plantwide quality control programs, and the press lauds local and regional bodies that adopt areawide programs. To encourage enterprise willingness to produce high quality products and new kinds of machinery, the new rules state that supervising ministries may revise enterprises plans when failure to meet them occurs because an enterprise is mastering the production of high quality producer goods or new consumer products.

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[21] Sovershenstvovniye, p. 68.

[22] Ekonomicheskaya gazeta, No. 51, December 1979, p. 26.

[23] Ibid, No 35, August 1980, pp. 11-14; Sobraniye postanovlennii Sovetov Ministrov SSSR, No. 2, 1980, pp. 27-31.

B. IMPROVING THE FUNCTIONING OF THE WHOLESALE DISTRIBUTION SYSTEM

First of all, the perennially balky system of rationing and distributing producer goods is to be made to function better by ensuring that both annual and five-year plans are balanced. This means, among other things, increasing the number of products for which these balances are made. For the 1981-85 plan, Gosplan compiled material balances for 409 products and distribution plans for 331, compared with 234 balances and no distribution plans in the previous 5-year plan.[24] Gosplan's distribution plans encompass 75 to 85 percent of output of the products concerned. In the 10-year plan now being worked on, Gosplan is compiling balances for 168 products. In annual plans, Gosplan makes balances for 2044 products, 331 balances requiring approval of the Council of Ministers. Gossnab makes annual balances for 7500 products, and the ministries for 25,000.[25] For the first time, regional plans contain material balances for five-year periods. Also, for the first time the five-year plan contains a separate section for material-technical supply.

The 1979 Decree and several followup issuances attempt to reinforce previously decreed programs. Use of long-term contracts between enterprises is to be extended. By 1990, such contracts are supposed to encompass 80 percent of total industrial production of the relevant goods.[26] Already, they cover substantial shares of iron ore and steel products, cement, timber, and agricultural machinery. In 1980, there were 136,000 of them, involving some 12,000 enterprises and associations (27 percent of the total). Producers of consumer goods are to sign five-year contracts with appropriate retail organizations, mainly units of the Ministry of Trade. These so-called direct ties are supposed to remain stable and to be arranged to promote efficiency in the distribution process. Two major new official issuances regulate procedures for concluding these contracts and relations between buyers and sellers, providing stiffer financial penalties for violation of contract terms.[27] In addition, failure to deliver goods as specified in contracts results in deductions from incentive funds of the delinquent enterprise and denial of all or a part of bonuses to its managerial personnel. Finally, Gossnab is to enlarge its network of small wholesale stores, where enterprises can purchase items without ration tickets, and to expand the practice of negotiating contracts with large enterprises or associations to supply all needed materials and equipment as a package deal.

To provide for handling bottlenecks and smooth out the production process in general, the 1979 Decree calls for building up Gossnab reserve stocks. Implementing this provision, Gosplan and Gossnab issued a decree providing for the setting of new reserve stock norms for 132 groups of products in the 1981-85 plan period. The new norms are substantially higher than those planned for 1980—three to four ties as high for rolled ferrous metals, 1.5 times for steel tubing, two times for trucks, and four times for armored cable.[28] These stocks are a part of the system of reserves of the Council of Ministers, intended for general use in the economy as needed, but strictly controlled.

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[24] Ibid, No. 21, July 1981, p. 8.

[25] Sotsialisticheskaya industriya, January 29, 1981.

[26] Khozyaystvo i pravo, No. 12, 1980, p. 10.

[27] Ekonomicheskaya gazeta, No. 20, May 1981, pp. 9-16; Ibid., No. 21, May 1981. pp. 9-16.

C. REVISION OF INDUSTRIAL WHOLESALE PRICES

A major revision of industrial wholesale prices, the first overall revision since 1967, took effect on 1 January 1982. The set of changes is not a price reform, since traditional Soviet approaches to administrative price fixing are retained intact. Thus, the new prices, like those they replace, are calculated on the basis of average unit labor, material, and depreciation costs plus an average percentage profit markup over cost. Excepted are crude oil and natural gas prices, for which a species of marginal cost pricing is used. Although little price information has been released thus far, several features of the new system have been described.[29]

First, the new prices will bring costs and prices generally into line by substantially raising prices of fuels, raw materials and many manufactured products. The overall level of prices will be raised by an as yet unspecified amount; retail prices are to remain unaffected. The new prices are intended to enable the average enterprise in each branch to earn a normal profit, so that branches such as coal mining, peat, and lumber, will once more become profitable. On the average, the new prices provide profit rates ranging from 12 to 15 percent among the various branches;[30] the profit rates are calculated relative to cost after deducting material expenditures.[31]

Second, the new prices incorporate certain costs heretofore covered by the state budget from general revenues. Social insurance charges, which in industry range from 4.7 percent to 9 percent among branches, are to be increased by an average of 50 percent, with rates ranging to a maximum of 14 percent.[32] The new prices are to cover all costs of geological prospecting work, only about half of which had been covered previously. The stumpage fee, which is a cost to lumber users and is paid to the budget to finance forest management, is to be doubled. Finally, product costs underlying the new prices will include a charge for use of water, which beginning in 1981 will be imposed differentially on enterprises and will be paid into local budgets.

According to statements at a recent conference on price fixing, the State Committee on Prices has revised and promulgated nearly 2,000 price lists—300 all-union lists and 1270 republic lists; altogether, some 900,000 individual prices and tariffs have been reviewed and approved.[33] Although details are sparse, it appears that the new price lists generally provide for finer differentiations to take account of relative quality, utility, and scarcity. In the case of crude oil prices, which are to rise 2.3 times, the number of regional price zones has been cut from 17 to three; within each price zone the base price will be set so as to cover costs of the highest cost producer. Other producers will, as was the case before 1979, pay rent (fixed payments) to the state budget calculated in rubles per ton. A uniform industrial wholesale price is to be set for all consumers. Finally new estimate prices and norms for construction are scheduled to take effect on 1 January 1984.

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[28] Planovoye khozaystvo, No. 8, 1980, pp. 42–43.

[29] Major sources are Voprosy ekonomiki, No. 6, 1980, pp. 12-21; Neftyannaya promyshlennost', No. 7, 1981, pp. 2–5; Kommunist, No. 8, 1980, pp. 45–59; Planovoye khozyaystvo, No. 5, 1980, pp. 33–43; and Sotsialisticheskaya industriva, Feb. 11, 1981.

[30] Voprosy ekonomiki, No. 2, 1981, p. 22.

[31] Ekonomicheskaya gazeta, No. 21, May 1980, p. 7.

[32] V. V. Lavrov et al, eds., Gosudarstvenniy byudzhet SSSR, Moscow, 1981, p. 311.

[33] Planovoye khozyaystvo, No. 7, 1981, p. 123.

D. STRENGTHENED FINANCIAL "LEVERS"

Several types of so-called levers are to be strengthened and extended under the new arrangements. They concern use and payments for bank credits, establishment of centralized ministerial funds for financing research and development, and gradual transfer of ministries and enterprises to a system of fixed profit sharing with the budget and to self-financing. With respect to bank credits, revised procedures and rates were introduced in a Council of Ministers decree. Beginning on 1 January 1981, bank monitoring of enterprise finances was increased, higher interest rates were imposed for a variety of stipulated infractions, such as overdue loans, and fines were levied on customers for failure to pay for orders on time.[34] Finally, enterprises are expected to use bank credits rather than budget grants to a greater extent, and construction firms are to use bank credits rather than customer advances to finance projects in progress.

To centralize funds for financing research and development, introduce new technology into production, and promote its mastery, the July 1979 Decree provides for establishing in industrial (and presumably other) ministries a single, "unified" fund to finance the planned R and D program and to reimburse enterprises for experimental production and startup costs. Except for a few ministries experimentally using the single fund, such costs previously had been financed in a variety of ways—but mainly from funds charged to enterprise production costs, contract receipts of research and design institutes, and the state budget. The new fund in each ministry is to be formed by a levy on enterprise profits calculated as a branch-wide percentage of the value of net output (marketed output in some branches). The rates are to remain fixed for a five-year plan, and expenditures from the fund are to be carried out on the basis of stable planned allocations. Levies for the unified fund will constitute a major charge on profits—they amounted to 12 to 26 percent (average 12.7 percent) of profits in some of the ministries.[35] In addition to profits, the fund is to be allocated a part of the price markups allowed on high quality products.

Even under the new arrangements, some R and D work will still be financed from budget funds and bank credits. The norm for forming the unified fund is to be set by the ministry concerned, based on its experience and its planned tasks for research and for mastering new technologies and products. It is argued that these unified R and D funds will improve ministerial oversight and direction of the R and D process and provide a better vehicle for repaying enterprises promptly for startup costs; failure to do so under the old arrangements was blamed for enterprise reluctance to innovate. Meanwhile, ministerial R and D institutes and design organizations are to be completely transferred to a system of self-finance, and rewards to their personnel are to be based on profits obtained. In the case of individual projects, bonuses are to be related directly to the estimated "useful effect" (cost savings) obtained by users from adopting the results of the projects.[36] Contracts are to be concluded to cover each large individual project ordered by a client enterprise, with payment for work to be made only when the entire project has been completed and accepted by the client. The institutes and design organizations are to arrange bank financing in the interim.

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[34] Ekonomicheskaya gazeta, No. 29, July 1980, pp. 11–12.

[35] Voprosy ekonmiki, No. 2, 1981, p. 133.

Ostensibly to motivate ministries and their subordinate units to strive for greater overall efficiency and to show concern for capital assets, the July 1979 Decree directs the transfer—"as they are ready"—of all industrial ministries to partial self-financing based on profit sharing. Long advocated by some economists and resisted tooth and nail by the bureaucracy, this arrangement was put into effect as early as 1971 in the Ministry of Instruments and Means of Automation (Minpribor) and extended with modifications to four other central ministries and a few local units. Two additional central ministries and some union republic ministries adopted the system in 1981.[37] Procedures for transfer to the new arrangements have been spelled out in a Gosplan instruction issued in February 1980, with no timetable specified.[38] Ultimately, ministries are supposed to apply the system of profit distribution and self-finance to all subordinate enterprises and associations.

As spelled out in the July 1979 Decree and Gosplan's instruction, the system is supposed to work as follows. The affected ministry (and subunit) shall be assigned a fixed amount of profit in rubles that must be paid into the state budget in each year of the five-year plan; the rest of the profits are to belong to the ministry (or subunit) to finance operations, strictly in accord with plan. The budget's allocation must be paid, even if the annual profit plan is not met. If the profit plan is overfulfilled by 3 percent or less, half the excess profits go to the budget; as do 75 percent of the excess profits if overfulfillment is greater. The budget's fixed amounts as well as all other rules of the game are supposed to remain unchanged during a five-year period. The budget's share of planned profits is supposed to be set as the sum of (1) the planned capital charge and fixed payments and (2) the difference between total planned profits and all other planned uses. Budget funds and bank credits may be used in cases where planned profits are not sufficient to cover planned investment and other requirements. Finally, ministries and their units must pay the capital charge on above-norm inventories out of the part of profits planned to be retained by them. Units using less capital than planned, and thereby realizing a savings on the capital charge, may keep the savings.

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[36] Ekonomicheskaya gazeta, No. 9, February 1980, p. 10; Ibid., No. 22, 1980, pp. 11-14.

[37] Ekonomicheskaya gazeta, No. 29, July 1981, p. 8.

[38] Ekonomicheskaya gazeta, No. 19, May 1980, pp. 7-8.

E. PLANNING APPROACHES AND TECHNOLOGIES

A major section of the July 1979 Decree is devoted to the theme of improving planning, continuing the idee fixe that better plans will produce better, that is, more efficient performance. Although none of the approaches is new, some receive much greater stress than in the past. First, the decree aims to accomplish in the 1981-85 plan what was supposed to but did not happen in the past two plans—namely, making the five-year plan the center of focus. The plan subdivided by years is to remain stable, and the incentive mechanism is geared to meeting five year goals; that is, the size of bonus funds and rights to bonuses depend on meeting an annual plan that reflects its cumulative contribution to meeting those goals. Second, great stress is placed on the system of counterplanning, whereby enterprises and their personnel are rewarded for voluntarily adopting an annual or five-year plan with higher targets than those set for the enterprises in the original plan. Third, the elusive "balance" in the input-output relations embodied in the plans is to be ensured, this time by considerably increasing the number of planned balances developed at the center. Regional plans are to be made more realistic and balanced by giving a larger role to local planning agencies. This aim was embodied in yet another government decree (published in March 1981) increasing the powers of local Soviets with regard to central ministries by requiring that the latter obtain concurrence of the Soviets for those parts of their plans (and any changes in them) that concern matters of "land use, environmental protection, construction, use of labor resources, production of consumer goods, and local infrastructure serving the population." [89] Material balances are to be developed by republic for the five-year plan, and labor balances by region and locality for annual and five-year plans. Fourth, many more plan targets and associated norms are to be specified for enterprises by the center. Fifth, the second phase of the computerized planning scheme (ASPR) is to be put into operation; its purpose is to speed up planning and raise the quality of plans through use of mathematical optimizing models and input-output techniques.

Sixth and last, but not least, this round of innovations substantially upgrades the status of so-called comprehensive or program-goals planning approaches, with the aim of focusing attention and resources on national or regional problems that cut across many sectoral lines. Also involved here is the desire to base five-year and long-term plans on the most realistic and comprehensive long-term scientific and technical forecasts possible. In this way, Soviet planners hope to reap the fruits of the scientific-technical revolution. The rhetoric on this theme has become a floodtide, whose real essence is frequently murky indeed. There are three basic types of these comprehensive programs—scientific-technical programs (nauchno-tekhnicheskiye programmy) intended primarily to guide scientific research and development; targeted economic programs

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[89] Izvestiya, Mar. 29, 1981.

(tselevyye kompleksnyye narodnokhozyaystvennyye programmy) aimed at coping with an economy-wide problem, and comprehensive programs for developing a particular region (territorial'noproizvodstvennyye kompleksy). Gosplan has promulgated methodological directives for preparing plans for such comprehensive programs.[40]

In May 1980, according to A. Bachurin, a Gosplan deputy chairman, Gosplan, Gostekhnika, and the Academy of Sciences formally ratified a list of 40 comprehensive scientific-technical programs and 120 programs to solve specific scientific and technical problems. Most are to be implemented in the 1981–85 plan and the rest in the 1986–90 plan.[41] Bachurin also states that 14 key "economic, social and technical programs" will be developed on the basis of published Gosplan methodologies "in the near future;" among them are programs for reducing the use of manual labor, stimulating more efficient use of fuels and energy, conservation of metals, expanding production of new consumer goods and development of the Baikal-Amur railroad (BAM) area. He then adds, "Development of the food program will be important for the nation."[42] An editorial in the April 1981 issue of Gosplan's Planovoye khozyaystvo states that "comprehensive programs should become an integral part of the new five-year plan. Priorities are food, development of the production of consumer goods and services, reduction of manual labor, growth of machinery, energy and transport, and likewise other large-scale programs."[43]

The directives for the 1981–85 plan do not list any particular comprehensive programs, but do refer to seven specific territorial-production complexes; these are: Western Siberia, Kansk-Achinsk, South Yakutia, Timano-Pechora, Kursk Magnetic Anomaly, Sayan, and Pavlodar-Ekibastuz.[44] The directives also state the intent to continue the comprehensive program for developing the Non-Black Soil Area. Writing in the February 1981 issue of Gosplan's journal, D. Zhimerin, deputy chairman of Gostekhnika, also refers to the 160 programs approved for the 1981–85 plan, stating further that 38 of them have been singled out as especially important, targeted programs.[45] He states that these programs provide for all necessary measures and assignments of responsibilities for carrying them out. He also mentions complex programs for fuel and energy, 13 programs for machinery, 18 programs concerning the agro-industrial complex, six of them targeted (one for grain). Coordinating commissions consisting of leading scientists and specialists have been approved for the programs. Some programs provide timetables for organizing serial production of new products based on completed research and design work, thereby reducing the usual large time gap between completed research and the mastery and production of products. In January 1982, Gosplan Deputy Chairman Bachurin stated that only 11 designated comprehensive programs had been included in the finally approved five-year plan.[46]

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[40] Ekonomicheskaya gazeta, No. 13, March 1980, p. 6; Ibid., No. 29, July 1980, pp. 11–14.
[41] Planovoye khozyaystvo, No. 1, 1981, pp. 22–23.
[42] Ibid, p. 22.
[43] Ibid, No. 4, 1981, pp. 6–7.
[44] Pravda, December 2, 1980.
[45] Planovoye khozyaystvo, No. 2, 1981, pp. 22–24.
[46] Economicheskaya gazeta, No. 1, January 1982, p. 1.

F. CHANGES IN ORGANIZATIONAL STRUCTURES

The July 1979 Decree specifies that the formation of production associations as the basic production unit in industry shall be completed in the "next 2 to 3 years." At the end of 1980, there were 4,083 production and science-production associations; they accounted for 48.2 percent of total industrial output.[47] Although the associations are supposed to merge enterprises, in fact more than two-fifths of their constituent units are independent enterprises.

In his speech to the 26th party congress, Brezhnev stressed the need to develop organizational forms to better coordinate activities of the numerous branch ministries in matters that cross sectoral lines. But the July 1979 Decree is silent on the matter, and the 1981–85 plan directives are vague. The decision seems to have been taken to accomplish the coordination process by proliferations of special commissions of the Council of Ministers and Gosplan and by appropriate reorganization of the internal structure of Gosplan. The following actions have been reported:

> A commission of the Council of Ministers was set up, probably in 1980, to oversee development of the West Siberian oil and gas complex; an interdepartmental commission under Gosplan was located in Tyumen.[48]
>
> A party-government decree of July 1981 established an interdepartmental commission under the Council of Ministers for conservation of raw materials, fuel and energy.[49] Its chairman is V. N. Martynov, head of Gossnab. Counterpart commissions are to be set up in republics, krays, and oblasts and also in individual ministries.
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> In 1981, a new State Committee for the Supply of Petroleum Products was established under the Council of Ministers;[50] its chairman is T. Z. Khuramshin. Apparently, this new committee takes over the functions of a network of petroleum product supply administrations that were subordinate to republic Councils of Ministers and to Gossnab.
>
> Gosplan has established several interdepartmental commissions—for energy, for BAM, for rationalizations of freight shipments, for use of secondary raw materials, for the food program, and for comprehensive use of useful minerals.[51] Ya. P. Ryabov, a Gosplan deputy chairman, heads the last two commissions mentioned.
>
> The internal structure of Gosplan has been reorganized to establish a number of comprehensive departments concerned with major targeted programs.[52] Details of the new internal structure have not been revealed.
>
> Two new ministries with activities related to the so-called Food Program have been created. They are the Ministry of the Fertilizer Industry and the Ministry of the Fruit, Vegetable, and Canning Industry.

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[47] Narodnoye khozyaystvo USSR v 1980 godu, p. 121.

[48] Pravda, Feb. 24, 1981.

[49] Izvestiya, July 4, 1981.

[50] Pravda, June 30, 1981.

[51] Ekonmicheskaya gazeta, No. 29, 1981, p. 8; Planovoye khozyaystvo, No. 6, 1980, pp. 127–128; Ibid, No. 1, 1981, p. 126.

[52] Kommunist, No. 10, 1981, p. 37.

V. EVALUATION OF THE NEW WORKING ARRANGEMENTS

A. IN THE RIGHT DIRECTION?

In no sense do the working arrangements set forth in the July 1979 Decree and its successors constitute a genuine reform of the economic system. Quite the contrary. Planning is more centralized, rigid, and detailed then ever; the scope for initiative of the producing units is more circumscribed; producer goods are more tightly rationed; administratively set, inflexible, average cost-based prices are retained; and intricate incentive systems are tied to meeting plans for many potentially conflicting variables, with priority given to production plans expressed in physical units. These changes move the system in a direction opposite from what most Western (and some Soviet) observers agree is needed—decentralization, flexibility, and introduction of market elements.

1. Increased centralization

The "new deal" now being implemented substantially increases the scope of central planning and the authority of Gosplan and the ministries. It does so by increasing the number of products whose production is planned and allocated by Gosplan itself. Moreover, Gosplan is taking on the role of quasi-ministry for a growing number of special projects, which are allocated materials and equipment by Gosplan separately from the ministries normally responsible. As a result, the number of so-called fundholders has proliferated from 92 in 1965 to 136 in 1970, 176 in 1975, and 303 in 1981.[53] A little over one-third of fundholders in 1981 were ministries and the like, and the rest special projects of one kind or another (mainly in construction). The changes also reinforce the central role of the industrial ministries, which are made arbiters of the formal rules and norms that govern subordinate units—whether enterprises or associations. In practice, the ministries administer the maze of incentive arrangements, interpreting them in ways that ultimately determine incomes and careers of enterprise managers, and using as tools several centralized discretionary reserve funds. Above all, the ministries can delay implemention of those formal arrangements that they regard as inimical to the welfare of themselves and their enterprises. By attempting to do more and more in greater and greater detail in Moscow, the central agencies—Gosplan, other state committees and the ministries—have become more than ever "leather-jacketed commissars working around the clock to replace the free market," to borrow the words of Alec Nove.

2. New planning contradictions

Three themes dominate the new emphases and arrangements pertaining to plans themselves: stability of plans and the underlying normative base oriented toward a five-year period, plan balance, and comprehensive, program-goals approaches. The goal of plan stability is to be accomplished largely by fiat, by declaring that plans and their normative underpinnings shall not be altered for the plan period. This declared intent is simply not realizable; to pursue such a goal is to chase a chimera. Planners cannot foresee the future, forecasts everywhere are likely to be frequently in error, and change and uncertainty are the essence of life. In practice, not only will frequent alterations in plan targets continue, but indeed, must continue. Failure to adjust targets to take into account actual changes in supply and demand would compound the rigidities and inefficiencies endemic to the Soviet production system, perhaps even bringing it to a halt.[54]

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[53] Planovoye khozyaystvo, No. 8, 1980, p. 35.

In this round of adjustments the long sought balance (consistency between planned outputs and the requisite imputs) is to be accomplished in both annual and in five-year plans through proliferation and modernization of the time-honored system of norms relating physical inputs to outputs and through an ukaz declaring that no investment project is to be included in an approved plan unless fully backed with required input allocations. In pursuit of the elusive balance and even more elusive efficiency in plans, Gosplan has been overseeing a massive effort to review, update, and proliferate norms of all kinds throughout the economy. On paper, of course, the production plan can be balanced by adjusting input/output norms and norms governing schedules for constructing and assimilating production capacities. Events likely will show, however, that the original norms were too optimistic about imput requirements and mastery of new capacities. Moreover, even if the originally planned normative relationships were realistic when formulated, they involve technical forecasts and output projections, that soon may be wrong because of unpredictable events, for example, unexpected difficulties in assimilating new plants and processes or crop failures. Meanwhile, the much larger number of input-saving targets set for enterprises increases the potential for error, and monitoring and enforcing the targeted savings will add greatly to the administrative burden on the bureaucracy. Finally, an added contradiction is inherent in the scheme of counterplanning, where enterprises undertake to do more than the approved plan requires and are rewarded for doing so.

The notion of comprehensive, goal-oriented planning seems sensible. In fact, however, superimposing this type of planning on the established routines immensely complicates the planning process in an economy that is centrally administered along sectoral lines. With even greater centralization and retention of sectoral management, all of the existing planning routines and computations must be retained. Now, the already overburdened central bodies must compile detailed plans for each of the many complex programs, ensure that their inputs and outputs are provided for and are consistent with all other sectoral plans, and see to it that the detailed requirements of a given program are introduced as separate line items in thousands of ministerial, sectoral, and enterprise plans so as to ensure implementation of the program. This is a herculean task. At the moment, Gosplan evidently is trying to cope with at least 11 comprehensive economic and perhaps 60 scientific-technical programs. In this effort, Gosplan is spawning new departments and commissions, not only to plan the programs but also to take an active part in their implementation. Thus, the administrative burden on higher echelons multiplies, and so will the economic inefficiencies stemming from excessive centralization of decisionmaking.

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[54] This point is treated in an excellent article by Raymond P. Powell, "Plan Execution and the Workability of Soviet Planning," Journal of Comparative Economics, Vol. I, No. 1 (1977), 51-76.

3. Fettering the production unit

Although production associations are slated to become the basic administrative unit in industry by 1985, experience with them in the 1970s suggests that their formation has made little difference. The press confirms that formation of associations has involved much formalism, many constituent units still retain the status of independent enterprises with separate balance sheets, some associations consist of only 2 or 3 plants; little product concentration and specialization has taken place, and the anticipated large cost savings have yet to materialize. Rather, their formation has increased the average size of Soviet industrial enterprises, already excessive by international standards. The millions of small, independent, efficient subcontractors—so much a part of the industrial structure in Western countries—have yet to appear on the Soviet scene. The latest set of changes in working arrangements, including formation of the associations, is not conducive to their emergence. Because of the scarcities of real inputs looming in the 1980s, the pressure for self-sufficiency (having one's own sources of supply) will be greater than ever.

Although one objective of the new arrangements is to "correctly" combine centralized planning with enterprise independence and initiative, the new rules of the game enmesh the producing unit and its managerial staff in an even denser thicket of targets, norms, rules, and incentive schemes than did the previous working arrangements. The list of centrally set plan goals and norms for enterprises is longer than before and covers everything that matters: growth of output (net or gross) in value terms; production of principal products in physical units, many more than before; growth of output of products in the highest quality category; growth of labor productivity; norm wages per ruble of output; number of employees; assignment for reduction of manual labor; normatives for forming each of the three incentive funds and the fund for financing R & D; total profits; commissioning of new production capacities; ruble ceiling on investment; assignments for new products and introducing new technologies; indicators of the technical level of production—for example, extent of automation or quality of products; economies to be obtained from introduction of R & D work; allocations of principal raw materials and machinery; targets for reduction in use of principal physical resources, many more than before; and (in annual plans only) all of the foregoing plus sales of products and payments to and assignments from the state budget (also set for five-year plans, if a fixed profit-sharing arrangement has been adopted). Moreover, the July 1981 Decree adds, beginning in 1983, goals for production cost with a ceiling on the value of raw materials included in cost. Besides these centrally set plan targets, the enterprise is supposed to conform to labor norms and standard staffing patterns, product standards and product certification procedures, and numerous other regulations.

The new arrangements add considerably to the already mazelike intricacy of the incentive schemes that are supposed to motivate enterprise managerial staffs to strive to produce more with less. Although there is considerable diversity, the general rules are as follows. First, more than a score of diverse bonus schemes are in effect. Second, the basic bonus funds from which the bulk of managerial bonuses are paid are formed from profits, and their size depends on enterprise performance with respect to labor productivity and share of products in the highest quality category. But various kinds of profits are omitted in figuring deductions into the funds and their size is affected by the system of counterplans, by enterprise performance in meeting contracts, and by some other variables. Third, even with money in the bonus funds, the amount of an individual manager's bonus for a particular month or quarter depends on meeting plans for labor productivity, product quality, and profits; entitlement to any bonus or a part of it requires fulfillment of those targets plus assignments for production of key products in physical units and for product deliveries under contracts. Bonuses are reduced for overexpenditures of wage funds, and ministries may specify additional requirements. Moreover, there are ceilings on the total bonus a manager may be paid. Finally, in 1983, managerial bonuses are to be made dependent also on the actual amount of material expenditures as compared with the limit set. Obviously, the scope for conflict among these multiple factors determining managerial rewards is great, the potential for optimizing (economically efficient) calculations by managers is small, and the potential for new behavioral aberrations is enormous.

Although it is unlikely that ministries and enterprises will shift soon to a profit-sharing system and financial autonomy, some observers believe that the proposed change has considerable potential for inducing more efficient enterprise behavior.[55] To us, however, the scheme has no such potential, a major reason being that it creates an incentive arrangement where the ministry or enterprise bears all the risk if it fails and reaps a sharply decreasing share of the reward if it succeeds. The enterprise bears the entire cost of failure to meet the profits plan, regardless of the reasons for that failure; conversely, if the enterprise makes additional profits above those planned, the budget automatically receives half or more of the extra profits. Thus, should an enterprise seek to maximize its profits, most of the reward for extra effort would go to the state treasury. Moreover, under both this and the present scheme, the enterprise is not the residual claimant to profits with discretion as to their use, for plans and regulations specify the uses to which all profits can be put.

Profit-sharing is part of a broad scheme of requiring ministries and ultimately firms to operate under conditions of complete financial autonomy, paying for all operations from profits and bank credit without budget subsidies or investment allocations. This step, it is argued, will induce units to use inputs more efficiently, to be more demanding of suppliers of raw materials and investment goods, and to cater to customers' wishes. In a word, the relevant entities, while remaining part of a state-managed production system, are expected to respond like business firms in a competitive market environment. Such an expectation is a grand illusion. Without any alteration in the economic environment, financial autonomy can amount to no more than a change in accounting rules. To make it effective in inducing the desired behavior, firms would have to be given broad freedom of action, alternative suppliers would have to be available, prices would have to reflect relative scarcities and utilities reasonably well, and government bureaucracies would have to retreat to overseeing the economy rather than directing it through detailed plans. None of these systemic modifications forms any part of the latest reform package.

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[55] Nancy Nimitz. "The July 1979 Decree and Soviet Economic Reform," Working Draft, RAND, October 1981.

B. IMPACT ON MANAGEMENT OF HUMAN AND MATERIAL RESOURCES

Together with slower growth of investment, the measures directed mainly at limiting enterprise demand for labor and better coordinating supply and demand in local labor markets may ease those difficult tasks somewhat. Probably, the most effective labor-saving factor, however, will be that extra workers will simply not be there. Managers will find it hard to bid away workers from other firms by offering higher wages, for the financial authorities clearly are determined to enforce strict control over wage expenditures and staffing patterns. Their record in this area has been rather good in recent years. The delegation of responsibility to local governments for compiling supply-demand balances for their regions and taking more responsibility for dealing with local problems is a positive step.

The revisions in working arrangements aimed at reducing the demand for intermediate goods (raw materials and energy) relative to final output do not give much promise of success. These measures include an expanded role for plan targets focused on such savings, tying these targets to the formal incentive system, and a shift from gross to net output as the primary value measure for enterprise production. The new wholesale prices also are structured to the same end—that is, prices of fuels, metals and lumber will rise sharply relative to prices of final goods such as machinery. The entire system of norms, both for materials and labor, is being revised to make them taut; it is these new norms that will underlie plan targets for specific material resource savings, for labor productivity, and for cost. Tightened input norms and limits on resource use are parts of the system of routines and pressures that in the past has enabled the economy to improve efficiency of resource usage as measured in physical units. Tying material resource savings and cost reduction to the bonus system is new, despite the abortive attempt made in the early 1960s. The difficulty is that these incentive arrangements are only part of an incredibly complex system of rewards and penalties.

The new rules add new indicators but do not really get rid of the old ones, thus proliferating conflicts and inconsistencies in the structure of regulators, rewards and penalties that confront producing units and their managers. Thus, val continues to be a feature of the system, because firms are set targets for sales, which essentially is the sum of contractual obligations, broken down into physical units and their corresponding prices. Managers' bonuses depend on meeting plans for contractual obligations and for the key products in physical units. In such an environment, rife with potentially conflicting signals, the need to pay attention to yet another variable—net output—will produce its own aberrations. Indeed, the press has reported their appearance in enterprises experimenting with the net output measure.[56] Because the principal component is wages, enterprises may be led to prefer labor-intensive products. Also, the revealed preference for producing those products that an arbitrary pricing system has made most profitable may be enhanced by the new indicator, one prominent minister has declared that to be the case in practice.[57]

These new working arrangements attack the problem of upgrading the quality of Soviet products and involve continuation of the incentive arrangements and the grading of products by quality that has been in effect since 1972. An outpouring of statistics would seem to support belief in a "great leap forward" in the average quality of Soviet products. As of October 1, 1980, over 85,000 products, accounting for 15.2 percent of the gross value of industrial output, had been awarded the Seal of Quality, signifying that their specifications were up to the best in the USSR and fully met world standards,[58] in 1975, the share was 6.5 percent. During the 1976–80 plan, the shares of output assigned to the highest quality category for various kinds of machinery reportedly increased as follows: power transformers—from 40.8 to 53.2; metal cutting machine tools—from 19.2 to 44.2; forge and press machinery—from 16.3 to 39.7; machinery industries as a whole—from 18.5 to 32.6.[59] In light industry, however, the share was only 7.1 percent.[60] Data of this kind are also given for particular ministries. That such statistics reflect actual achievements is open to grave doubt, because (except for a few machines, such as cars and ships), Soviet exports of machinery to the West did not rise, and because factor productivity in industry has continued to deteriorate, despite the infusion of all of those supposedly high-quality machines.

New price markups provide higher profit rates for new and high quality products, so as to encourage their production in competition with highly profitable old products that constitute the bulk of output. Thus, sale of highest quality products in 1980 contributed only from 1.8 to 8.6 percent of total profits among 12 machinery ministries, with an average of 3 percent for all machinery.[61] The new mandatory product certification procedures, along with substantially higher profit markups and the longer duration allowed on new and more efficient products and machinery, may indeed induce producers to put out such products. Whether the outcomes will be real or spurious depends on whether products certified as meeting world standards actually do so. One would expect to find evidence of product quality in the better salability of Soviet manufactures in world markets, increased efficiency of domestic production, diminished unsellable stocks, and fewer complaints by consumers.

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[56] Planovoye khozyaystvo, No. 6, 1980, p. 9.
[57] Ibid, p. 116.
[58] Voprosy ekonomiki, No. 12, 1980, p. 115.
[59] Ibit, p. 117.
[60] Finansy SSSR, No. 4, 1981, p. 45.
[61] Ekonomicheskaya gazeta, No. 44, October 1981, p. 21.

The extremely intricate working arrangements that constitute the latest round of changes in planning and incentive arrangements are no panacea for the ills of the Soviet economy. Those ills stem largely from three fundamental features of the system: (1) the lack of a reliable (efficent) guide to choice; (2) the attenuated influence of consumers on producers and (3) the absence of the discipline of competition among suppliers. Even the reformed prices are poor indicators of real resource costs. The absence of efficient prices deprives all derivative value categories—sales, value of net or gross output, profits, profitability—of genuine economic content. Thus, efforts to induce economizing behavior from producers by tying rewards and penalties to meeting targets for any or all of these categories are doomed to failure. Enterprises can be expected to respond to the modified incentive structure by focusing on aspects of performance that they perceive have highest priority in the judgment of superior bodies. Manipulation of product mixes so as to meet one or another value target is likely to be pursued in the interest of meeting the plan rather than the requirements of customers. Response to new relative prices for labor and materials is likely to be slow and limited. Finally, there is no sign that inefficient or unprofitable firms will be closed down.

Indeed, an argument can be made that any really serious effort to implement widely the latest basket of innovations in planning and management will make matters worse. The greatly increased centralization and complexity of planning will push the bureaucracies to the limits of their capabilities. The perennial changes in the rules of the games facing the producing units will distract their managerial staffs from the business of running their firms and make decisionmaking at that level extremely difficult. The avalanche of regulations, norms, and incentive rules directed at reduced use of physical resources, together with the campaign-like approach that is being used to help solve this problem, is unlikely to induce resource savings at rates any higher than in the past. In fact, many economically inefficient consequences could ensue from this approach, which seems to be based on the notion that "any reduction in energy or metal or labor per unit of output is a universal good." This fixation would preclude decisions in particular cases, for example, to produce a product with higher content of steel per unit of output, even though that product would sell easily or enable some producer to reduce product costs. These economically efficient choices are denied the Soviet economy because of inefficient guides to economic choice and the lack of consumer guidance of production. The absence of these features over a half century of production activity and politically motivated choice has produced a pattern of physical resource use that deviates in millions of detailed ways from an economically efficient pattern. These distortions have now become so pervasive that they constitute severe fetters on production. Bit by bit, the physical production plant has been put out of kilter throughout the entire production-distribution chain. The present round of reforms does nothing to put it right.

SOVIET POLICY TOWARDS TECHNOLOGICAL CHANGE SINCE 1975

By Martin C. Spechler*

CONTENTS

	Page
Summary	89
I. Introduction	89
II. Execution and modification of the Kosygin reforms	91
III. Investment policy	97
IV. Results of technology policy	99
V. Problems and prospects	100

SUMMARY

Aware of the need to improve productivity, the Soviet leadership has extended and developed the Kosygin economic reforms with respect to the use of the sales indicator, certification and price reform, and material incentives. But a number of former practices have recurred which do not promise better results in raising productivity. They include overambitious and detailed planning, gross output targets, personal recriminations, and the dispersion of production. Nevertheless, the USSR has made selected progress in a number of areas, as shown by licenses sold and exports to the West. The volumes are still small; extension would seem to depend on a reduction of macroeconomic stress on the economy. This is shown by sensible changes in investment policy which cannot be carried into practice to the proper degree because of budget limits.

I. INTRODUCTION

During the past five years—indeed, fifteen now—the Soviet authorities have devoted much effort to improving the technological performance of their economy by many bureaucratic measures, but without essential change to the centrally administered character of the system. Most recently, centrally set tasks have pushed economic indicators aside as the principal means of evaluating Soviet enterprises, though material incentives continue to be important. As this report will show, much of the cautious economic reforms of the mid-1960's has been diluted or worn away.

Ever since the Tenth Five Year Plan (1976–80) was proclaimed a "plan of quality," Soviet officials have stressed the need to improve processes and products, including consumer goods, as the chief lever for further moves forward by the Soviet people. This stress continues until today. "Improving efficiency and quality" is the declared "fundamental principle" of the Eleventh Five Year Plan, now in progress.[1] Yet statements and slogans like these have not derived from any incisive diagnosis of the Soviet productivity complaint; nor have they pointed to a coherent course of treatment. Rather, judging by official pronouncements, everything good about the Soviet economy is to be "strengthened."

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Perhaps no more was to be expected from the aged and weakening top leadership. With Prime Minister Alexei Kosygin and Anastas Mikoyan gone and not yet replaced by men of similar experience in civilian manufacturing and trade, the immediate prospects are even slighter than in 1975 for a decisive turnabout.

The USSR in 1982 needs to obtain higher use values for its more slowly growing supplies of human effort and other scarce resources. This much is fairly evident to the Soviet leadership, even though recent poor harvests and their effects in every area of the economy have obscured the basic trends.

Harvard Professor Abram Bergson has demonstrated that almost all of the reduced Soviet GNP growth in 1970–75 as against 1950–70 can be attributed to reduced growth in the productivity of material inputs.[2] After adjusting for sources of factor productivity other than technical progress proper in the material sectors—such as economies of scale and reallocation of labor from agriculture—Bergson finds that the Soviet rate of advance in technical progress and general efficiency was much lower in the 1970's than it was in the 1950's.

A similar decline has occurred in the capitalist West, of course. Some part of the Soviet slowdown could have come from a worldwide retardation in technical progress as applied and measured. So the Soviets are still able to claim a rate of growth in national income per capita for Comecon and the USSR in particular which somewhat exceeded the rates shown by the EEC and the USA during 1975–80.[3]

Measured Soviet GNP growth does not necessarily parallel improvements in the standard of living. Progress in this latter may exceed measured productivity gains for several reasons. Even when recalculated according to Western practice, new goods are usually valued at their relative cost to produce, not in relation to their power to please. Many new and better goods have appeared in the Soviet economy over the years. In 1980 the Soviets claimed 4000 new models of machinery, instruments, and equipment were created.[4] New model consumer goods are regularly announced in Ekonomicheskaia Gazeta. Of course, many so-called new goods in the Soviet Union appear only as a way to circumvent price controls; the real improvement may be slight or nil. This has always been so and may have been particularly significant in periods of repressed inflation and just before a comprehensive price reform. The last three or four years constitute just such a period.[5] Consequently no one can say whether genuinely improved goods have come onto the Soviet market faster than before.

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[1] Speech by Leonid I. Brezhnev to the Plenum of the Central Committee of the Communist Party of the Soviet Union, Nov. 27, 1979. Pravda, Nov. 28, 1979, p. 2.

[2] GNP in constant prices was estimated by Rush Greenslade and Abram Bergson to have decelerated from an annual rate of 5.89 percent over 1950–60 and 5.29 percent over 1960–70 to a rate of only 3.83 percent over 1970–75. Since weighted inputs grew at roughly constant rates throughout these three periods, estimated productivity growth had to fall from about 1.9 percent per year in the 1950's to 1.5 percent in the 1960's and 0.1 percent in the first half of the 1970's. Even with an adjustment for poor weather, the 1968–78 period showed only 0.6 percent yearly advance. Abram Bergson, "Soviet Technological Progress: Trends and Prospects," Harvard Institute for Economic Research Discussion Paper No. 814 (February, 1981), prepared for the conference, "The Soviet Economy: Toward the Year 2000."

[3] Vestnik Statistiki, No. 12, 1981, p. 73. The slowdown of the 1970's as compared with earlier periods is deliberately obscured. Here the Soviet concept of national income is employed.

[4] Izvestia, Jan. 24, 1981, pp. 1–2.

Another source of underestimation in the reported Soviet GNP growth rates could be the semi-legal and illegal production of high-quality clothing, food, furniture, housing, and so forth, which has been more salient in the 1970's than before. Because of its still limited scope, though, this under counted production does not seem sufficient to erase the Bergson finding of reduced technical progress (including efficiency gains or losses) during the 1970's.

Manifestly the Soviet leaders have perceived the urgency of accelerating technical progress. Prime Minister N.A. Tikhonov has stated that 85–90 percent of the increased national income planned for the Eleventh Five Year Plan (1981–85) must come from increased labor productivity.[6] Since investments are not supposed to rise faster than the 18–20 percent envisioned for material national income, this means that rising capital intensity will contribute less than previously to rising labor productivity. Input-saving innovations must do more than before to keep growth rates up. Since the investment needs of the primary sectors and of transportation are pressing, furthermore, it is practically inevitable that industrial investment cannot rise from year to year as it has in the past.[7]

As is recognized by the Soviets themselves, net able-bodied manpower supplies will dwindle during the 1980's.[8] Lower rates of growth in labor inputs must hamper growth, but labor productivity need not be retarded, particularly if the labor force gains in average experience and on-the-job training. As against this, the ethnic and geographic mix will probably be less favorable.

The Soviets may have to get used to slower growth, as have the Czechs, Hungarians, and East Germans. The lower Five Year Plan targets indicate as much. Nevertheless, increased technical progress and efficiency are strongly preferred by the authorities, and for that reason they have insisted on action in almost every direction—and at once.

II. EXECUTION AND MODIFICATION OF THE KOSYGIN REFORMS

As of now, the Kosygin reforms of 1964–66 have not been declared dead, nor has anything replaced them conceptually as the basis for improving economic management in the USSR. Yet only a few of the Kosygin ideas have been developed, while many supplementary measures adopted since 1966 have diluted the potency of the original reform intent. In practice, as we shall see in this section, many of the old, repressed evils of the Khrushchev and Stalin times have returned.

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[5] One indicator of inflationary pressure, the rate of collective farm to state store prices, reached 2.09 in 1980 as compared with 1.76 in 1975 and 1.55 in 1970. Pravda, Nov. 16, 1981.

[6] Pravda, Feb. 28, 1981, pp. 2–4.

[7] Even the production of numerically controlled units has been reduced. Izvestia, Mar. 14, 1979.

[8] See the article by Academician A.G. Aganbegyan in Ekonomika i Organizatsiia Promyshlennogo Proizvodstva, October, 1979, pp. 3–19.

A chief merit of the Kosygin reforms, as will be remembered, was to put sharper emphasis on sales (and profitability) as success indicators for the Soviet enterprise. Gross output, staffing, and wage structure were demoted, if not erased, in reports to superior agencies. Following up this idea and that of "direct links" between suppliers and trade organizations, the Soviet light industrial enterprise was to sign contracts with distributors and to count towards fulfillment of its plan only goods produced and sold according to the agreed assortment.[9] How has the sales indicator worked?

Interviews with Soviet economic officials as well as common sense confirm that forcing the Soviet factory to sell its output increases the relative power of customers to dictate quality, assortment, and delivery conditions, particularly if chronic overfull demand can be moderated.[10] Still, formalism has crept in. Some producers have been able to insist that prospective customers sign essentially blank contracts or order before the wares are displayed at trade fairs.

Even when it has worked, the emphasis on sales has created new problems for the economic system as a whole. The sales indicator as such may encourage material intensiveness at the expense of quantity. According to the economist Lokshin, the sales indicator has encouraged production of more expensive deluxe models of steel cookware, especially complete sets, while the number of items has fallen. He reports that enterprises have cut production of the cheaper items of clothing, hosiery, and leather footwear.[11] This need not be desirable and indeed could be a way of concealing inflation. Good or bad, a firm will try where possible to produce an assortment high in purchased materials and low in value-added.[12] The normative net output indicator, whose introduction is discussed below, is intended to counter this tendency.

Let's suppose a better model product costs less. Its chances of being adopted are poorer than they ought to be because its introduction would mean the factory has to produce more just to make the original sales target.[13] We now learn that if output quality is maintained even with newer and cheaper materials, prices are supposed to remain unchanged until the end of the plan. Such good intentions notwithstanding, mid-plan changes in financial arrangements are reportedly frequent. Even were prices maintained to the end of the present plan, desirable cost savings would endanger the fulfillment of the next plan. In the case of construction materials, moreover, both the producer and the customer typically want to maximize cost of the work.[14]

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[9] Voprosy Ekonomiki, no. 7, 1978, pp. 54–64. This requirement supposedly came into legal force in 1970. Reforms, it seems, never die, but they can be born many times.

[10] When obsolete appliances and shoddy clothing and footwear exceeded demand in the mid-1970's, trade officials refused some 10–12% of them. Pravda, August 16, 1975; Planovoe Khoziaistvo, no. 3, 1977, pp. 3–11.

[11] Planovoe Khoziaistvo, no. 8, 1981, pp. 49–56. A similar preference for expensive types has been reported by the Ministry for Machinery for the Light and Food Industries. Voprosy Ekonomiki, no. 4, 1979. On the shortage of wallpaper caused by planning in rubles and the consequent improved quality, see Pravda, Aug. 3, 1980, p. 3.

[12] See complaints from the Ministry of Instruments, Automation Equipment, and Control Systems in Izvestia, Jan. 9, 1982, p. 2.

[13] Literaturnaia Gazeta, Oct. 6, 1976; Voprosy Ekonomiki, no. 2, 1978, pp. 109–110.

The sales revenue indicator puts pressure on transportation, trade inspection, and financial facilities. What if a customer doesn't pay? A burly enforcer might be dispatched.[15] In consequence, it has now been decided that the State Bank will extend credit against accepted invoices. Whether or not this measure reduces tolkach business trips and urgent telegrams, it must reduce the power of trade organs to reject poor quality and wrong assortment, particularly if orders cannot be sold to the ultimate consumer.[16] Trade organizations, too, have their sales targets to meet and hardly benefit from exacting fines. Perhaps as a partial offset, the State Bank is now instructed to stop payment for shipments if there is no demand.[17]

Possibly anticipating such difficulties with the sales indicator, the Kosygin reform envisioned the need for separate assortment assignments in producers' goods industries and for prices which would stimulate the socially desirable production plan in both branches. In principle, new prices were to be set with useful properties in mind. A little progress was in fact made by the 1967 price reform. In the 1982 lists the prices of 55 types of machinery are to be computed according to useful characteristics, though admittedly many semifabricates will continue to be valued in tons.[18] For example, stampings are to be favored over the more wasteful rolled sections in metals prices. Progress on pricing by use-value has been slow.

Soviet reluctance to deviate from familiar cost-pricing can be explained, in my opinion, by the practical impossibility of finding a formula for pricing goods in excess demand according to their various uses without permitting windfalls and other apparent distortions in allocation.[19] Prices much above average costs inflate investment costs and permit wage drift, both hindrances to central direction of the economy.

Insofar as gross output remains a planning index, conventional units such as running meters of productive capacity have not generally replaced weight or units. Writes one Soviet commentator:

> This is confirmed by the unsuccessful attempt to plan the production of steel pipe in running meters (instead of tons). In this case no consideration was given to the interests of the customers who, having at their disposal authorizations for a certain quantity of pipe in running meters, had the option (within the limits of this quantity) of ordering pipe with varying wall thickness. For petroleum workers, for example, the possibility of increasing the "coefficient of safety" proved to be a decisive factor, and they began ordering thicker pipe. The contradiction between the produc-

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[14] Interview with N.T. Glushkov, chairman of the USSR State Price Committee, Ekonomicheskaia Gazeta, no. 17, 1980, pp. 7–8.

[15] Pravda, Nov. 10, 1977, p. 2, on this new role for the tolkach (expediter). About 5 percent of all invoices go upaid, according to one reported sample.

[16] About 0.2–0.6 percent of consumer durables were returned as defective by consumers in 1980—rather low figures relative to known rates of defects when the independent state inspectorate has taken samples. For an interesting discussion of these rates, see the Soviet Analyst, vol. 10, no. 19 (Sept. 23, 1981), pp. 5–8.

[17] Ekonomicheskais Gazeta, no. 40, 1975.

[18] A.V. Bachurin, vice-chairman of USSR Gosplan, in Ekonomicheskaia Gazeta, no. 1, 1982, p. 2. Further improvements in the proper costing of labor, water, and other natural resources will be made.

[19] Metals will be paid for according to quality, announced the chairman of the State Price Committee with satisfaction, "even when this quality is greater than that specified in the customer's order!" Ekonomicheskaia Gazeta, no. 17, 1980, pp. 7–8.

> er and the user was unexpectedly manifested in the increased thickness of the pipe to the detriment of national economic interests. It became necessary to return to the previous procedure of planning the production of pipe with one refinement: two indicators are planned for the producer: the mass and length of pipe in running meters, even though the ton once more occupied the dominant position.[20]

One might note in passing that agricultural procurement prices for high quality cotton and other industrial inputs are to be differentiated by quality to a greater degree than before from now on. This would almost certainly be a favorable step, for defective hides, fibers, oils, and foodstuffs have hampered the quality of the corresponding Soviet consumer goods.[21]

A second direction of Soviet policy to promote technical progress has been certification of quality. An extension of the state standards procedure, certification requires rating all products according to whether they meet or exceed world (or best Soviet) levels, are currently satisfactory (so-called first class), or are obsolete and subject to removal from production (second class). These certification ratings have proceeded to the point where now the percentage of top-or first-quality production can be a success indicator for Soviet enterprises, for production associations, or more informally even for ministries.[22] Previously no such direct qualitative indicator had figured in the evaluation of progressiveness of factory output, although technical innovations had always been included in yearly plans. By the late 1970's certified quality ratings were serving as a criterion for price cuts [23] or sometimes, when a new producer's good was awarded the Seal of Quality (Znak Kachestva), premia (nadbavki) and enhanced profitability and bonuses.[24]

During the late 1970's the Znak Kachestva became the subject of campaigning, as can be judged by the rapid increases in the rates at which they were awarded for consumer goods and the fall in rejection rates. More than 85,000 types could display the pentagonal seal by the year 1981.[25] Reports in the Soviet press tell of formalism, deception, and the common failure to produce certified Seal of Quality items in significant quantities. Until very recently, however, consumer goods granted the Seal did not typically carry higher price markups than similar items without. Rather, bonuses were given to the collectives responsible. The reluctance to grant price premia probably reflects uneasiness on the part of Soviet financial and trade authorities about the likelihood of fraudulent profiteering in the consumer goods field, where objective indicators of high quality are partial at best and where scarcities are still felt in many areas.

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[20] G. Kiperman, "The Effectiveness of Production and Economic Indicators," Voprosy Ekonomiki, no. 2 1978, pp. 107–14, as translated in Problems of Economics, XXI, no. 7 (November 1978), p. 32, fn. 5.

[21] Ekonomicheskaia Gazeta, no. 4, 1981, p. 19. Cf. Planovoe Khoziaistvo, no. 3, 1979, pp. 92–93, on the lack of quality-related prices on oil seeds, sugar beet, etc.

[22] Pravda, Mar. 12, 1975, pp. 1–3, and Nov. 30, 1978, pp., 1–2, for the growing extent of this index since the mid-1970's. Up to 1979 the index of top-quality production was not generally tied to bonuses. Voprosy Ekonomiki, no. 3, 1979, pp. 144–47.

[23] Ekonomicheskaia Gazeta, no. 43, 1979, p. 5.

[24] While supposedly producers are to be given 30-50 percent of the difference between cost and the value to users of the new article, often no such premium is set. Izvestia, Mar. 23, 1974, p. 2, gives the example of trucks. Voprosy Ekonomiki, no. 5, 1978, pp. 33–44, also speaks of the small share of the "economic effect" of new technology which redounds to producers. Since older items are still sold at fixed prices despite any cost savings achieved, it often happens that old machines are more profitable to produce than new, even with the premium price. Proposals to institute "sliding" prices on machinery to reduce their profitability with time do not seem to have been accepted widely.

[25] Ekonomicheskaia Gazeta, No. 49, 1981, p. 7.

Some change has come about on this matter. Faced with greater inflationary pressure in the late 1970's and early 1980's, Soviet superior agencies have seen the necessity of adjusting prices upwards to consumers, especially on luxury items.[26] Their covering excuse is the need to compensate for higher quality. "To increase their volume," it is stated, new consumer goods will be given temporary wholesale and retail prices such that profitability on them will not exceed 125 percent of the normative for that kind of goods.[27] Initial lots and "especially fashionable items" can carry higher prices if the customer agrees.[28]

Premium retail prices for three years will go to goods recognized by the ministry of Trade's All-Union Permanent Pavillion of the Best Models of Consumer Goods, or its republican affiliates. At the very least, such price adjustments can reduce store queues and the attendant temptations for poorly paid clerks.

Developments with respect to the sales indicator and certification may be seen as fair extensions of the Kosygin reforms. Not so the resolution, "On Improving Planning and Strengthening the Economic Mechanism's Influence in Enhancing Production Efficiency and Work Quality," approved by the Central Committee of the Party and announced in Pravda and Izvestia on July 29, 1979.[29] This multifarious collage of instructions, together with the authoritative interpretations in the months following, marks a major reversal of direction in Soviet policy towards technical change.

First, we have a reassertion of the planning principle, particularly the role of five-year plans, in the technical field as well as in the allocation of resources. In the Eleventh Five Year Plan, no fewer than 409 types of yearly material balances are to be struck—versus only 234 in the Tenth. The vice-chairman of U.S.S.R. Gosplan, A. V. Bachurin, exulted that 11 comprehensive programs, 41 specific scientific and technical programs, and 130 special measures to solve technical problems were taken into account in the 1981–85 plan. He hopes to save 6.8 billion rubles (exactly!) through management improvements during the Eleventh Plan. More auxiliary, local, and detailed production is to be planned by republican Gosplan, Gossnab, or the responsible industrial ministry, even where actual production is widely dispersed.[30]

The interests of the state should always come before the interests of the enterprise, we are reminded. Gosplan has expanded rights; the enterprise's legal rights are largely forgotten.

Secondly, we observe a proliferation of reportable success indicators. The share of top-quality output, labor productivity, limits on manual labor, normative output, and more may be added to the manager's operational plans. These additional indicators reflect a reasonable Soviet concern to save scarce labor, fuel, and materials while increasing quality and quantity of output. Yet the very multiplication of indicators dilutes the role of the few synthetic indicators which the Kosygin reforms proposed to stress.[31] What is more, the many new or renewed indicators have increased confusion at management levels and the excuse for petty interventions.[32]

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[26] On Sept. 15, 1981, prices of such luxury items as cashmere shawls, high-grade furniture and china, and yachts (!) were raised 25–30 percent while less popular watches, nylon clothing were 12 to 37 percent in price. Established auto models have doubled in price. Vodka and tobacco cut prices are up—has their value been enhanced?

[27] Ekonomicheskaia Gazeta, October 1979, p. 5.

[28] Ekonomicheskaia Gazeta, no. 17, 1980, pp. 7–8.

[29] Translated in the Current Digest of the Soviet Press, vol. XXXI, No. 30, pp. 1–6, 14.

[30] Pravda, Aug. 12, 1981; Ekonomicheskaia Gazeta, No. 1. 1982, p. 2.

Much has been made of the introduction of normative net output as an index for 27 ministries by 1982. This follows prolonged debate and experimentation. Enterprises will be credited with output net of purchased inputs (at branch input-output norms), all computed by the Price Committee in official prices. This rather involved procedure may save materials. Will it not also produce anomalies of its own, particularly when the normatives and prices are not promptly reviewed?

It is true that the July 1979 resolution again promises stable five-year plan normatives. This means that initiatives from below to increase labor productivity or save materials will be rewarded for a time—until the better results are written into the new plan drawn up according to "achieved levels." The so-called counterplans have assumed stability in demands by superior agencies, but in fact changes are made without prior notice and not always to the enterprise's satisfaction. Complaints in the Soviet press say that collectives who promise better results often do not get the materials or financial resources they need, though wage funds are supposed to be related to output these days.[33] Consequently, counterplans have become rather uncommon.[34]

Aside from these measures, the July resolution reaffirms and extends a broad range of familiar Soviet reforms. For example, bonuses are to be paid on the brigade system more than before. Group incentives—a reasonable, if hardly radical, system where individual responsibility cannot be identified—can result in the conventional division of the conventional bonus, thus encouraging conservatism as much as innovation.

There has also been a very cautious extension of the notion that (above-plan) profits should be shared with the enterprise, at some rate like 50 percent. But the State Budget is guaranteed a minimum payment, even if the enterprise has to borrow from the State Bank to make it![35]

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[31] Reportedly the typical Soviet enterprise now can gain bonuses according to about 20 separate success indicators, including savings of fuel, production for export, above-plan profits, use of waste products, and so forth. Pay for higher labor productivity remains niggardly, however, even though there is more talk nowadays about enlarging material incentives for quality work and reducing them for returns of defective goods. Voprosy Ekonomiki, No. 6, 1979, pp. 69-75; Pravda, Feb. 23, 1980.

[32] Complained one manager when his machine tool ministry insisted on the old tonnage measure of gross output: "In our business you can't succeed without tons, they're in the plan. Supplier are distributed by tons. Not only that—everyone's used to them. Pravda, Aug. 10, 1981, p. 2.

[33] In 18 ministries as of 1981. Trud, Jan. 19, 1980, p. 2. The measure was intended to reduce excessive wage payments when plans are exceeded. Planovoe Khoziaistvo, no. 10, 1979, pp. 38-46.

[34] Only 2-3 percent of all enterprises in the coal, ferrous metallurgy, and power engineering branches had counterplans last year. About 6.6 percent of Soviet enterprises nationwide did, in contrast to 37 percent in 1977. Often counterplans are little more than socialist competitions with documentation. Managers have learned to ask for additional safety factors in their planned outputs and inputs in case someone volunteers them for such an initiative from below. Pravda, Jan. 12, 1982, p. 2.

[35] See the rather strong criticism of the implementation of this reform in Ekonomika i Organizatsiia Promyshlennogo Proizvodstva, no. 9, 1981, pp. 3-16, by the director of the financial ad-

Continued

Psychoanalysts speak of the "return of the repressed" at times of reduced alertness, as in nightmares. Some of Brezhnev's last statements remind us of the phenomenon. There has been a quite distinct return to the idea of personal, even criminal, responsibility for the economic misdeeds of organizations. In his speech to the Central Committee Plenum of November, 1979, the Soviet President demanded that "specific persons to blame for consumer products in deficit because of negligence, irresponsibility, and stupid bungling must be found and punished." (Pravda adds: Shouts of "Yes!" and applause heard in the hall.) Threats of demotions, higher fines, and recriminations recall N.S. Khrushchev, not to mention darker periods of Soviet life. It is not all bluster this time. A director in the Ukraine who did not see to proper plating for baby carriages was sentenced to a year of corrective labor, probably far from the baby carriages.[36]

I have already mentioned the continued use of the gross output indicator—often in tons or units—for setting wage and bonus funds and approving investments, particularly in producer's goods industries. Another hoary Soviet distortion not entirely dormant is the discontinuous bonus function. According to one report from the Ministry of Instruments, Automation Equipment, and Control Systems' All-Union Computer Equipment Association, "If your plan is underfulfilled even by 0.1 percent, the collective is deprived of incentives and the engineering and technical personnel don't get bonuses." [37] As is well known, such a discontinuity encourages firms to "storm," that is, to skimp on quality, distort assortments, and neglect maintenance at the last minute to make 100 percent fulfillment by the end of the reporting period, thereafter relapsing into an informal half-holiday. Since quality controllers remain under the director's control and receive bonuses dependent on the fulfillment of the enterprise plan, they can hardly protest.[38]

Finally, research and development institutes are to be paid on work completed according to contracts. The idea of paying them according to the economic effect actually achieved has not made much progress in the last decade.

III. INVESTMENT POLICY

Some reasonable changes have been announced in the allocation of investments with the aim of saving labor and materials during the Eleventh Five Year Plan. Instead of building so many new enterprises, more money is to be spent on reequipping older ones. Investments on established sites reportedly have one-third the payoff period of new plant and equipment. For one thing, they exploit overhead labor already in place. Investments in mechanized preparation of raw materials, in finishing, and in quality control would answer chronic deficiencies in older Soviet enterprises. Many ma-

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ministration of the USSR Ministry of Instruments, Automation Equipment, and Control Systems.

[36] Pravda, Jan. 16, 1980, p. 6; also Izvestia, Oct. 25, 1981.

[37] Izvestia, Jan. 9, 1982, p. 2. The director continues, "Shortages of materials, violations of contracts, and changes in schedules for the commissioning of capacities . . . makes managers conceal existing reserves for the next maneuver."

[38] Ekonomicheskaia Gazeta, No. 1, 1981, p. 2.

chines have been used too long in Soviet production and repair shops.

Ministries are to be given increased funds for underwriting the incidental, but often major, expenses of technological change.[39] These funds compensate enterprises in cases where costs cannot be included in sales or earn a profit.

One major target area during the coming two five-year plans will be material handling equipment, intended to replace some of the estimated 10 million manual workers who load and unload freight and move stocks in the Soviet Union today. Unfortunately, this kind of equipment, as well as packaging material fabricators, has been neglected too long. As a result, many needy ministries and enterprises have long ago gone into the business in a small way. Some 40 ministries produce materials handling equipment; dispersion over 400 plants undoubtedly causes high costs and low quality. Only 15 percent is planned centrally. But will managers and ministerial officials give up their self-sufficiency? Experience with repair shops in the USSR indicates not.[40]

Maybe to capitalize on the lopsided research and development capacity built up over the years, Brezhenev and other Soviet leaders have called explicitly for defense and heavy industry to give more of a hand in the production of consumer goods.[41] After all, heavy industry already produces more than half of all the nonfood consumer goods in the Soviet economy.[42] Defense industries were projected to produce 1.9 times more consumer durables in the Tenth Five Year Plan than before.[43] The chemical industry in particular must manufacture more of the plastic and chemical everyday items which are often so short in Soviet shops.[44] The Ministry of Aviation is enjoined to take a leading role in improving baby carriages (airborne?) [45] Despite the formal responsibility for such consumers' goods placed on the "head" ministry, one wonders if even the branch principle re-established by the Kosygin reforms has not been diluted. Consumers' good ministries often do not directly control the majority of production capacity appropriate for their branch. The actual manufacturer often sells locally. Surely the technical and market research done in the institutes of the head ministry will have a long and winding way to go before some heavy industrial plant takes notice. Most technical research in the USSR is not published, so direct personal contracts are crucial. This may be an important reason for the failures of the Soviet economy to apply ideas developed somewhere in the USSR or readily available abroad.

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[39] Ekonomicheskaia Gazeta, no. 40, 1976. A large increase in such credits has been reported for 1976–79. By contrast, the Kosygin reforms aimed at putting more money from depreciation, sales of equipment and profits into the hands of managers themselves.

[40] Sovietskaia Rossiia, July 22, 1979, p. 2; Voprosy Ekonomiki, no. 2, 1978, pp. 107–8.

[41] Pravda, June 1, 1980, p. 1; Brezhnev's report to the 26th Party Congress, Pravda, Feb. 24, 1981.

[42] Pravda, Feb. 24, 1981, p. 20.

[43] Ekonomika i Organizatsiia Promyshlennogo Proizvodstva, no. 5, 1978, pp. 35–51.

[44] Pravda, Jan. 19, 1980, p. 2, complains that heavy industrial ministries do not allocate enough materials to such things as stainless steel kitchen utensils, though waste by-products can and should be used.

[45] Pravda, Nov. 14, 1978.

IV. RESULTS OF TECHNOLOGICAL POLICY

No candid and careful observer of the Soviet Union would want to dismiss the technological progress made by Soviet designers and engineers during the 1970's. The four million innovations and rationalizing proposals reportedly introduced in 1980 alone cannot all be worthless. Outside studies have shown as much.[46] Soviet introduction of continuous casting, high voltage transmission lines, nuclear power, numerically controlled tools, and other major innovations did not lag more than a few years behind the West. Their diffusion has been slower in the USSR, partly owing to Soviet reluctance to scrap old equipment. On the other hand, plastic goods and civil communications have been quite backward.

Sale of licenses overseas has grown. In 1976, the last year for which data were available, 119 were sold, as compared with 330 in the five years previously. According to the Economist, Comecon countries have sold 124 licenses to American companies in the past decade, including ones for electromagnmetic casting of aluminum and copper and for coal-gasification. The Japanese steel industry has used many Russian inventions. More such licenses could be sold in the West, says the London-based newspaper, if the Soviets did not impose so many bureaucratic difficulties and release so little of the needed auxiliary information with the license.[47]

Furthermore, Soviet reluctance to allow their best technicians and engineers to spend extended time in the free world makes it rather unattractive to buy sophisticated and comple technology from them, as such systems require knowledgeable installation and post-sale service, not to speak of ready spare parts.

One final proof of Soviet technical ability in civilian goods is their ability to penetrate advanced capitalist markets. Overall, the levels of USSR manufacturing exports to advanced capitalist countries are meager. Of the 15.8 billion rubles of exports to these countries in 1980—32 percent of Soviet export trade—oil, natural gas, and other raw materials constitute the vast bulk and value. Machines and equipment (categories 10–19) were but 291 million rubles of the total for 1980, down from 357 million rubles to the same 19 countries in the previous year. In 1975, the total was 246 million rubles.[48] So some aggregate progress has come about, despite the recession in the West.

Let's look more closely at Soviet exports of manufactures to the West, where quality considerations are no less important than price. We see selective successes with products where Soviet technology has advanced in the past and production capacity allows export in suitable quantities and quality. The Soviets claim to have exported 109 thousand motor vehicles to the West in 1979 and 81 thousand in 1980, roughly a quarter of their total export of these items to all customers. Export market penetration by Soviet Russia is strangely unbalanced, possibly reflecting trade deals and special bilateral arrangements. Belgium takes twice to four times the number of automobiles as does West Germany; Canada bought nearly three times the number that Italy did in 1980. Finland purchased about 1 in 10 of the vehicles exported by the USSR to the West. On the other hand, Soviet tractors, despite their acceptance in Canada for some years now, were little sold in the West during 1979–80.

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[46] R. Amann, J. M. Cooper and R. W. Davies, "The Technological Level of Soviet Industry," New Haven: Yale University Press, 1977; Martin C. Spechler, "The Pattern of Technological Achievement in the Soviet Enterprise," The Association for Comparative Economics Studies Bulletin, XVII, no. 1 (Summer, 1975), pp. 63–88.

[47] The Economist, May 15, 1982, p. 101.

[48] Vnesniaia Torgovlia, various years. For such items the constant ruble price comparisons would be little different, though no appropriate price index exists.

Soviet watches, cameras, and some chemical products continue to find some Western markets, occasionally in surprising quantities. In 1976 the USSR apparently sold more than one million watches and mechanisms in Great Britain, 595,000 in West Germany, and 1.78 million in the USA. About a quarter of a million Soviet cameras were sold on advanced Western markets in that same year.[49] These may have been specially prepared for export. What appears abroad and in foreign currency shops inside the USSR notoriously cannot be purchased readily even in Moscow department stores. Conversely, what appears on the shelves and thus apparently cannot be sold readily is often the wrong size, the wrong style, or the wrong finish. This applies to refrigerators, black-and-white television, furniture, shoes, and much else in the Soviet Union. Brezhnev was the loudest—or the most amplified—critic on this count. One wonders, though, why the leaders of the world's second superpower must attend to the supplies of wallpaper, stationery, frost-free refrigerators, spare parts for tractors, and so forth. All these were dealt with in the latest Central Committee resolutions.

V. Problems and Prospects

As in the West, many problems have contributed to the slowdown of the Soviet economy. In particular, an atmosphere of stress does not favor reform. Soviet experts recognize that lack of reserves, engendered by harvest and other economic failures as well as the heavy defense burden, constricts the room for decentralization. Reduced investment budgets affect quality improvement equipment first of all.[50] We have seen that the last few years of the Brezhnev regime were characterized by the return, albeit unrecognized, of some of the repressed practices of the past—the proliferation of overdetailed planning tasks and targets, the weakening of enterprise autonomy, distorting success indicators, and personal recriminations for organizational failures. Much, if not all, of the Kosygin reforms has been washed away by the rush of supplementary measures designed to solve ad hoc, if pressing, problems.

Little incisive and comprehensive analysis of the Soviet economy has found its way into permitted dissent during the late 1970's.[51] On the other hand, some indications of interest in the Hungarian model have pushed through the censorship, if only in a guarded form.[52] Aside from this and the radical critiques by ex-Soviet economists, testifying to a sense of desperation within the USSR, one can perceive little expressed hope for major systemic improvement in Soviet tehcnological policy or for broader achievements in practice this side of the horizon.

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[49] Ibid.

[50] Voprosy Ekonomiki, no. 1, 1978, pp. 37–45.

[51] In the 1950's and 1960's such dissent could be published within the USSR. Dina R. Spechler, "Permitted Dissent in the USSR," New York: Praeger, 1982, passim.

[52] Literaturnaia Gazeta, Mar. 17, 1982. The Soviets are characteristically reluctant to admit an interest in the successes of other, smaller states, so we are reminded that the Hungarians are also taking a keen interest in the Soviet practice in retailing.

SOVIET POLICY OPTIONS IN TRADE RELATIONS WITH EASTERN EUROPE

By Michael Marrese* and Jan Vaňous**

CONTENTS

		Page
I.	Introduction	102
II.	Implicit AND subsidies non-market benefits in Soviet trade with Eastern Europe	103
III.	Possible Soviet policy responses to trade subsidization of Eastern Europe	107
IV.	Policy options for Eastern Europe	113
V.	Conclusions	115

TABLES

1.	Projection of intra-CMEA foreign trade prices, world market prices and derived dollar/ruble exchange rates for 1980–85	108
2.	Projection of Soviet-East European trade, 1980–85	109
3.	Projection of Soviet-East European trade valued at comparable world market prices converted into dollars	109
4.	Calculation of the implicit Soviet trade subsidy to Eastern Europe	110
5.	Projected Soviet aggregate export prices, import prices, net and gross barter terms of trade with Eastern Europe, 1980–85	110

I. INTRODUCTION

Government monopoly of foreign trade transactions, currency inconvertibility, barter, and bilateralism are attributes which have been associated with Soviet trade relations with Eastern Europe. Soviet decisionmakers often argue that these foreign trade control mechanisms better enable them to: (1) engage in long-term, quantitative planning with greater certainty of supply; (2) control the composition of exports and imports; (3) maintain separate systems of prices for domestic producers, domestic consumers, and foreign trade enterprises; and (4) promote coordination and specialization among socialist economies, thus serving as a vehicle for socialist integration. It is also evident that these attributes have contributed to the multi-dimensional interdependence that exists today between the Soviet Union and Eastern Europe.

One aspect of this interdependence is trade subsidization. The Soviet Union has been "subsidizing" certain East European countries by exporting "hard goods" (fuels, non-food raw materials, and to a lesser extent also food and raw materials for food) at special intra-CMEA foreign trade prices (ftps) which are below the corresponding world market prices (wmps) in exchange for imports of "soft goods" (machinery, equipment, and industrial consumer goods) at CMEA ftps which are above the corresponding wmps. Hence, two different sets of terms of trade exist simultaneously for the Soviet Union—prevailing two-way terms of trade on the world market as well as what appear to be inferior one-way terms of trade with East European countries [1]—because the Soviet Union has been willing to export more hard goods to Eastern Europe than it imports from Eastern Europe, and to import more soft goods from Eastern Europe than it exports to Eastern Europe.

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Because trade between East European countries shows bilateral balancing of hard goods for hard goods and soft goods for soft goods, some aspect of the Soviet Union's relationship to Eastern Europe, other than socialist or ethnic solidarity or purely altruistic motives, may hold the key to understanding the presence of the two sets of terms of trade. This brings us to the second aspect of interdependence, namely that Soviet national security has been produced from a combination of Soviet troops and military hardware in the Soviet Union, Soviet troops and military hardware stationed in Eastern Europe, and the allegiance of East European countries. This implies that the allegiance of East European countries can serve as a substitute for the use of Soviet labor and capital in providing security services to the Soviet Union. Moreover, we contend that the Soviet Union engages in preferential trade treatment of Eastern Europe relative to the rest of the world in order to substain the allegiance of East European countries. Here allegiance refers to military, political, ideological, and non-market economic benefits that are secured through preferential bilateral trade treatment, which we collectively label "unconventional gains from trade."

This paper discusses the policy implications of these two aspects of CMEA interdependence. Section II provides a brief overview of the methodological approach and statistical findings which appear in our monograph Implicit Subsidies and Non-Market Benefits in Soviet Trade with Eastern Europe. Section III explores possible Soviet policy responses to substantial trade subsidization of Eastern Europe, while Section IV examines the policy options for Eastern Europe. Conclusions appear in Section V.

II. IMPLICIT SUBSIDIES AND NON-MARKET BENEFITS IN SOVIET TRADE WITH EASTERN EUROPE [2]

Implicit Soviet trade subsidies are defined as the opportunity cost of trading at intra-CMEA ftps with the CMEA Six (Bulgaria, Czechoslovakia, East Germany, Hungary, Poland, and Romania) rather than at wmps with the Developed West (Western Europe, North America, Japan, Australia, and New Zealand). The Soviet Union implicitly subsidized the CMEA Six during 1960–80 in the sense that the value of Soviet exports to the CMEA Six based on wmps (East-West trade prices were used as the relevant wmps) was greater than the value of the same exports based on intra-CMEA ftps. On the other hand, the value of imports from the CMEA Six based on wmps was smaller than the value of the same imports based on intra-CMEA ftps. Thus, although the cumulative Soviet trade balance with CMEA Six calculated from actual official statistics was basically close to zero, the hypothetical trade balance calculated from data based on wmps showed a huge surplus, i.e., a hidden trade subsidy. For 1960–80, the present value in 1980 dollars of the subsidy is estimated at $87.2 billion.

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[1] The term two-way terms of trade implies that a given amount of good A can be exchanged for a particular amount of good B on the world market, which in turn, can be exchanged for the original amount of good A, and vice versa. The term one-way terms of trade implies that a given amount of good A can be exchanged for a particular amount of good B, but this amount of good B can be exchanged only for a lower than original amount of good A, or vice versa.

[2] See Marrese and Vaňous (1982) for details dealing with this section.

In the presence of incomplete sample coverage and unbalanced overall trade, we calulated implicit Soviet trade subsidies in the following three steps. First, for each CMEA partner country, quasi-exchange rates were derived, on the basis of a sample with less than 100 percent coverage, to translate ruble trade flows valued at intra-CMEA ftps into dollar trade flows valued at wmps. These derived exchange rates were constructed separately by commodity category and for exports and imports between the Soviet Union and each CMEA Six country. Second, using the derived exchanged rates, Soviet ruble trade flows with each CMEA country were converted to dollars. We assumed that the exchange rate calculated on the basis of the available sample of commodities (or on the basis of other information when no sample was available)[3] was valid for the entire trade in a given commodity category. In the final step, the Soviet intra-CMEA trade balance measured in dollars and at wmps was adjusted for a non-zero overall ruble trade balance by subtracting the product of the Soviet intra-CMEA trade balance meaured in rubles and at ftps times "the settlement exchange rate."[4] If the adjusted result is positive (negative), it represents an implicity Soviet trade subsidy (tax) to a CMEA country in a particular year.

Calculation of implicit Soviet trade subsidies to the CMEA Six indicates an upward trend, marked by large variations around the trend, over time.[5] During the period 1960–78 (covered by our original study), the subsidies, measured in current dollars, reached their lowest level in 1963–96 million dollars—and their highest level in 1974—6265 million dollars.[6]

Five different phases in the level of subsidies can be recognized. During the first phase (1960–64), between the intra-CMEA ftp revisions of 1957–58 and 1964–65, these subsidies averaged about $186 million dollars annually. During the second phase (1965–69), after the 1964–65 intra-CMEA ftp revision took place, the subsidies averaged about $474 million dollars annually due to the deterioration in the Soviet terms of trade with Eastern Europe vis-a-vis the trends in relative wmps. As a result of the temporary surge in wmps of primary commodities in 1970–71, the average level of implicit subsidies reached about $975 million dollars annually during the third phase (1970–71). In 1972 and probably throughout most of 1973, these subsidies were in the 600 to 800 million dollar range; thus during the fourth phase (1972–73), the subsidies were close to the trend line observed during the period 1965–69. The rapid growth of wmps of fuels in late 1973 and 1974 pushed the level of subsidies to about $1628 million dollars in 1973 and to an annual average of about $5776 million dollars during the fifth phase (1974–78).

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[3] Unit-value comparisons based on a sample of commodities within a commodity category could reasonably be assumed to approximate price comparisons for seven aggregate commodity trade flows. However, for three aggregate commodity trade flows—Soviet exports of machinery and equipment, Soviet imports of machinery and equipment, and Soviet imports of industrial consumer goods—unit-value comparisons yielded nonsensical results; hence, an alternative method of deriving these quasi-exchange rates was utilized.

[4] The settlement exchange rate is the rate at which trade surpluses or deficits denominated in rubles could have been eliminated by dollar payments to or from the Soviet Union. For each CMEA country we selected a different settlement exchange rate, namely the derived Soviet dollar/ruble exchange rate for imports from the particular CMEA country.

[5] The figures presented here incorporate the authors' best estimates of the quality discount factors which were utilized in deriving quasi-exchange rates for Soviet imports of machiney and equipment, Soviet imports of machinery and equipment, and Soviet exports of industrial consumer goods. In Marrese and Vaňous (1982), sensitivity analysis utilizing two sets of less reasonable quality discount factors (indicating better quality of CMEA manufactured goods relative to the quality of the Developed West's manufactured goods) demonstrate that the quantitative results found here are not driven by our particular choice of quality discount factors.

[6] Estimates of the level of subsidies in 1979–80 are presented below.

One annual measure of the increasing burden of this subsidization on the Soviet Union is the ratio of implicit Soviet trade subsidies to the CMEA Six divided by the current dollar value of total Soviet exports to these countries. This annual measure, in percent, averaged 8.1 for 1960–64, 14.0 for 1965–69, 17.7 for 1970–73, and 33.8 for 1974–78. During the entire period 1960–78, Soviet subsidization increased steadily, showing that increases in subsidies cannot be characterized as a temporary phenomenon following the 1973–74 upheaval world market prices of fuels.

For 1960–78, the present value of these subsidies to the CMEA Six, which measures the resource transfer in 1980 dollars inclusive of compound interest (all pre-1980 subsidies are compounded to 1980), is about $57.7 billion. Even though our research focused primarily on 1960–78, we also estimated in a rough fashion subsidy magnitudes for 1979 and 1980. Predictably, in view of the rapid growth in the wmps of oil versus the relatively slow growth in the intra-CMEA ftps of oil, these subsidies have dramatically risen. The 1980 present value for 1979 subsidies is estimated at $11.6 billion (10.4 billion in current dollars), and for 1980 subsidies at $17.8 billion.[7] These magnitudes are staggering—the 1979 level corresponds to approximately 47 percent of total Soviet imports from the Developed West in that year, and the 1980 level to about 70 percent of these imports.

In part, implicit Soviet trade subsidies are a fortuitous consequence of pricing according to the CMEA price-formation formula. In effect since 1975, this formula states that ftps in a given year are set equal to an arithmetic average of wmps (converted from dollars to rubles at the official ruble/dollar exchange rate) for the five proceding years. However, these subsidies, in part, represent a conscious decision by the Soviet political leadership to trade at terms favorable to Eastern Europe. Evidence includes the following: the Soviets have not altered the CMEA price-formation systems since 1975 in any basic way, even though it was predictable that the maintenance of the status quo would have clear long-term disadvantages for the Soviet Union; deviations from CMEA pricing rules have generally worked to the economic detriment of the Soviet Union; and the Soviet Union has accorded differential treatment to individual CMEA trading partners. The presence of these subsidies does not indicate that the Soviet Union has been irrational or that it is squandering gains from trade. Rather, it suggests to us that the Soviet political leadership may be maximizing a utility function that incorporates military, political, ideological, and certain special economic variables in addition to conventional gains from trade.

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[7] These are rough estimates using projected ruble/dollar conversion rates based on the 1978 derived ruble/dollar exchange rates and our estimates of ruble price inflation within CMEA and dollar price inflation on the world market of goods in five main commodity categories.

An examination of the distribution of implicit Soviet trade subsidies among the CMEA Six countries relative to our specualtive ranking of the value of unconventional gains from trade received by the Soviet Union was employed as a test of whether the Soviet Union subsidizes individual countries in a rational manner. Our definition of rationality is the maximization of both conventional and the unconventional gains from trade. Our overall ranking, based on qualitative considerations of the unconventional gains from trade during 1960–78, is in descending order: East Germany, Czechoslovakia, Bulgaria, Hungary, Poland, and Romania.

With respect to the distribution of implicit Soviet trade subsidies during 1960–78, the present value of subsidies in 1980 dollars were as follows: $23.7 billion for East Germany, $12.0 billion for Czechoslovakia, $10.1 billion for Poland, $7.8 billion for Hungary, $4.6 billion for Bulgaria, and net implicit taxes of $0.5 billion for Romania. Individual country shares during the above period amounted to: East Germany—41 percent, Czechoslovakia—21 percent, Poland—17 percent, Hungary—14 percent, Bulgaria—8 percent, Romania—minus 1 percent. However, if we only look at the post-1974 period, we find that Bulgaria's share increased to about 17 percent, while East Germany's share declined to 32 percent, with the remaining shares largely unaffected. For the most part, the flow of subsidies was from the Soviet Union to Eastern Europe. However, in the case of Bulgaria during 1960–69, the implicit subsidies were negative. In other words, Bulgaria and Romania paid implicit trade taxes to the Soviet Union.

Since the above comparisons do not take into account the population of individual CMEA countries, the ranking of countries presented above does not necessarily indicate the degree of relative overall importance attached to them by the Soviet Union. Employing the 1970 population of each country as a population normalizer, the estimates of the present value of capita average annual subsidies in 1980 dollars during 1960–78 were 73 for East Germany, 44 for Czechoslovakia, 41 for Hungary, 16 for Poland, and one for Romania. Per capita estimates during 1974–78 turned out to be the highest for Bulgaria (163 dollars a year), followed by East Germany (73 dollars), Czechoslovakia (44 dollars), Hungary (41 dollars), Poland (16 dollars), and Romania (1 dollar). The dramatic rise in Soviet subsidies over time is especially apparent from the data for the CMEA Six taken together, While during 1960–64 the present value of average annual subsidies, measured in 1980 dollars, amounted to about 6 dollars a year per person in Eastern Europe, during 1965–69 this amount increased to almost 12 dollars, it reached 20 dollars during 1970–73, and then tripled again, reaching about 78 dollars during 1974–78.

On the whole, both the total subsidy ranking and the per capita ranking of implicit Soviet trade subsides conform, to a satisfactory extent, to our ranking of unconventional gains from trade provided by CMEA Six countries to the Soviet Union. Especially notable are the absence of subsidization for Romania, a country which in general has not offered unconventional gains from trade to the Soviet Union, and the first and second positions of East Germany and Czechoslovakia respectively, which correlates perfectly with their relative strategic value to the Soviet Union.

III. POSSIBLE SOVIET POLICY RESPONSES TO TRADE SUBSIDIZATION OF EASTERN EUROPE

Soviet policy responses to trade subsidization of Eastern Europe may not be considered without taking into account anticipated U.S. behavior toward the Soviet Union. For a host of sensible reasons, we believe that the most likely policy direction of the U.S. will not include widespread economic warfare against the Soviet Union. Thus, most current trading arrangements with Western firms, including importation of advanced technology, cooperation agreements, and joint ventures, will be among Soviet policy options. Nevertheless, the Soviet Union realizes that the current U.S. administration's politically motivated partial trade restrictions affect not only trade with the U.S., but also trade with Western Europe and Japan. Thus, the perceived riskiness of relying on the West has increased since the detente of the mid-1970s, which should make the Soviet Union more willing to continue to underwrite the costs of gradual East European re-industrialization.

Another issue that immediately comes to mind when considering possible Soviet policy responses to the presence of trade subsidies is whether these subsidies are desired or undesired. We define the desired subsidy as being based on intended assistance and the undesired subsidy as being based on foregone windfall gains or losses due to unanticipated short-term fluctuations of wmps from their long-term trends. In Marrese and Vaňous (1980d) this issue is examined via econometric analysis. We conclude that despite the presence of enormous undesired subsidies in 1974 and to a much lesser extent during 1975–78, the size of desired subsidies was a substantial portion of total subsidies during 1960–78. However, the unanticipated increases in energy wmps during 1979–80 point toward the renewed presence of large undesired subsidies during these two years. Thus, on one hand, there is evidence that the Soviet Union has allocated subsidies consciously. On the other hand, the Soviet political leadership began the 1981–85 period acutely aware of the high, unintended cost associated with transferring resources to Eastern Europe via trade subsidization. While undesired subsidies serve as a measure of the inefficiency of the current system of exchanging Soviet resources for unconventional gains from trade, it is also possible that unanticipated wmp movements, coupled with the continued use of the present CMEA price-formation formula, could produce windfall gains for the Soviet Union. Beginning in 1975, intra-CMEA ftps have changed annually and have been based, especially for fuels, raw materials, and other relatively homogenous commodities, on a five-year moving average of lagged wmps. Hence, if wmps of Soviet exports stagnate or decline and wmps of Soviet imports increase, then the level of Soviet trade subsidization would decline. Using Tables 1 and 2 presented below, it is apparent that this hypothetical pattern of wmps is unlikely to occur. The wmps of those commodity categories in which the Soviet Union has a net trade surplus—fuels, and non-food raw materials—are projected to grow more rapidly than the wmps of those commodity categories in which the Soviet Union has a net trade deficit—machinery and equipment, food and raw materials for food, and industrial consumer goods.

TABLE 1.—PROJECTION OF INTRA-CMEA FOREIGN TRADE PRICES, WORLD MARKET PRICES, AND DERIVED DOLLAR/RUBLE EXCHANGE RATES FOR 1980–85

[1980=100 for price indices]

	1980	1981	1982	1983	1984	1985
Machinery and equipment:						
Intra-CMEA foreign trade prices	100	108	114	120	125	130
World market prices	100	99	99	103	118	132
Derived dollar/ruble exchange rate	0.80	0.73	0.69	0.69	0.76	0.81
Fuels (Soviet exports):						
Intra-CMEA foreign trade prices	100	127	157	188	216	239
World market prices	100	110	105	105	113	125
Derived dollar/ruble exchange rate	2.75	2.38	1.84	1.54	1.44	1.44
Fuels (Soviet imports):						
Intra-CMEA foreign trade prices	100	107	125	143	159	173
World market prices	100	139	145	142	146	154
Derived dollar/ruble exchange rate	1.27	1.65	1.47	1.26	1.17	1.13
Nonfood raw materials:						
Intra-CMEA foreign trade prices	100	112	119	127	135	140
World market prices	100	92	93	100	110	119
Derived dollar/ruble exchange rate	1.70	1.40	1.33	1.34	1.39	1.45
Food and raw materials for food:						
Intra-CMEA foreign trade prices	100	112	120	123	128	131
World market prices	100	91	90	96	104	111
Derived dollar/ruble exchange rate	1.33	1.08	1.00	1.04	1.08	1.13
Industrial consumer goods:						
Intra-CMEA foreign trade prices	100	111	115	120	125	131
World market prices	100	94	94	98	112	125
Derived dollar/ruble exchange rate	0.92	0.78	0.75	0.75	0.82	0.88

Source: Intra-CMEA foreign trade prices: projection based on the official intra-CMEA price-formation formula, which states that prices in a given year are set equal to an arithmetic average of world market prices converted from dollars to rubles at the official ruble/dollar exchange rate for the five preceding years.

Official ruble/dollar exchange rate: 0.65 in 1980, 0.72 in 1981, and then projected at 0.74 in 1982, 0.69 in 1983, 0.66 in 1984, and 0.64 in 1985. World market prices: own forecast based on the Wharton World Model projection of world market prices.

Derived dollar/ruble exchange rate: 1980: revised estimate based on Goldstein [1982]; 1981–85: projection based on changing relationship between intra-CMEA ruble price level and world market dollar price level for individual commodity categories.

TABLE 2.—PROJECTION OF SOVIET-EAST EUROPEAN TRADE, 1980–85

[Million current rubles]

	1980	1981	1982	1983	1984	1985
Soviet exports:						
Machinery and equipment	6,219	6,600	7,090	7,460	7,770	8,080
Fuels	8,582	10,848	12,670	15,170	17,980	20,510
Nonfood raw materials	5,478	6,120	6,630	7,220	7,830	8,280
Food and raw materials for food	152	210	250	280	320	360
Industrial consumer goods	488	520	560	610	660	720
All goods	20,919	24,298	27,200	30,740	34,560	37,950
Soviet imports:						
Machinery and equipment	10,584	11,791	13,030	15,090	17,290	19,780
Fuels	401	360	500	570	640	690
Nonfood raw materials	2,777	3,080	3,340	3,630	3,940	4,170
Food and raw materials for food	1,864	2,050	2,280	2,440	2,640	2,810
Industrial consumer goods	3,469	3,870	4,210	4,830	5,540	6,380
All goods	19,095	21,151	23,360	26,560	30,050	33,830
Balance of trade:						
All goods	1,824	3,147	3,840	4,180	4,510	4,120

Source: 1980: "Wharton CPE Foreign Trade Flow Data Bank" [1982].
1981: "Wharton CPE Current Analysis," Apr. 12, 1982, p. 4.
1982–85: forecast based on the following assumptions about the growth of real exports and imports:
Exports—Machinery and Equipment: no growth in real terms during 1982–85.
Fuels: 6 percent decline in 1982, no change in 1983, 3 percent growth in 1984, and no change in 1985.
Non-Food Raw Materials: 2 percent growth in real terms during 1982–85.
Food and Raw Materials for Food: 10 percent growth in real terms (starting from a very low base) during 1982–85.
Industrial Consumer Goods: 4 percent growth in real terms during 1982–85.
Imports—Machinery and Equipment: 5 percent growth in 1982 and 10 percent annual growth thereafter.
Fuels: no growth in real terms during 1982–85.
Non-Food Raw Materials: 2 percent growth in real terms during 1982–85.
Food and Raw Materials for Food: 4 percent growth in real terms during 1982–85.
Industrial Consumer Goods: 5 percent growth in 1982 and 10 percent annual growth thereafter.

TABLE 3.—PROJECTION OF SOVIET–EAST EUROPEAN TRADE VALUED AT COMPARABLE WORLD MARKET PRICES AND CONVERTED INTO DOLLARS

[Million current dollars]

	1980	1981	1982	1983	1984	1985
Soviet exports:						
Machinery and equipment	4,980	4,820	4,890	5,150	5,910	6,540
Fuels	23,600	25,820	23,310	23,360	25,890	29,530
Nonfood raw materials	9,310	8,570	8,820	9,670	10,880	12,010
Food and raw materials for food	200	230	250	290	350	410
Industrial consumer goods	450	410	420	460	540	630
All goods	38,540	39,850	37,690	38,930	43,570	49,120
Soviet imports:						
Machinery and equipment	8,470	8,610	8,990	10,410	13,140	16,020
Fuels	510	590	740	720	750	780
Nonfood raw materials	4,720	4,310	4,440	4,860	5,480	6,050
Food and raw materials for food	2,480	2,210	2,280	2,530	2,850	3,180
Industrial consumer goods	3,190	3,020	3,160	3,620	4,540	5,610
All goods	19,370	18,740	19,610	22,140	26,760	31,640
Balance of trade:						
All goods	19,170	21,110	18,080	16,790	16,810	17,480

Source: Ruble trade flows taken from table 2 multiplied by derived dollar/ruble exchange rates taken from table 1.

TABLE 4.—CALCULATION OF THE IMPLICIT SOVIET TRADE SUBSIDY TO EASTERN EUROPE

[Million current dollars]

	1980	1981	1982	1983	1984	1985
Balance of trade valued in dollars	19,170	21,110	18,080	16,790	16,810	17,480
Minus dollar value of ruble trade credits	1,680	2,520	3,030	3,550	4,010	3,790
Implicit subsidy	17,490	[1]18,590	15,050	13,240	12,800	13,690

[1] This estimate differs slightly from the one found in Marrese and Vatous [1982] because it is based on derived dollar/ruble exchange rates found in Goldstein [1982].

Source: Balance of trade valued in dollars: Table 3 dollar value of ruble trade credits: ruble balance of trade taken from table 2 converted by the following commercial dollar/ruble rates—0.92 in 1980, 0.80 in 1981, 0.79 in 1982, 0.85 in 1983, 0.89 in 1984, and 0.92 in 1985 commercial dollar/ruble exchange rate: 1980–81: average of Hungarian and Polish exchange rate, 1982–85: authors' own projection.

TABLE 5.—PROJECTED SOVIET EXPORT PRICES, IMPORT PRICES, NET AND GROSS BARTER TERMS OF TRADE WITH EASTERN EUROPE, 1980–85

[1980 equals 100]

	1980	1981	1982	1983	1984	1985
Exports:						
Value	100	116	130	147	165	181
Prices	100	117	132	148	164	176
Volume	100	99	98	99	101	103
Imports:						
Value	100	111	122	139	157	177
Prices	100	109	116	122	127	132
Volume	100	102	105	114	124	134
Terms of trade:						
Net terms of trade	100	107	114	121	129	133
Gross barter terms of trade	100	103	106	115	123	130

Source: Value of exports and imports: calculated from table 2 prices of exports and imports: calculated from table 1, using data from table 2 as weights.

Volume: calculated by dividing the value index by the price index Net terms of trade: the ratio of aggregate export prices and import prices Gross barter terms of trade: the ratio of the import quantity index and the export quantity index; this ratio measures de facto cost of real imports, i.e., it indicates the purchasing power of exports in terms of imports.

Our general aim in constructing Tables 1–5 is to establish an overall understanding concerning the trade implications of continued use of the CMEA price-formation formula in the present form. Thus, any particular figure in these tables should be treated with caution. More concretely, Tables 1–5 are based upon projections of wmps, derived dollar/ruble exchange rates by commodity category, a commercial dollar ruble exchange rate, the official ruble/dollar exchange rate, Soviet exports, and Soviet imports. While each projection is subject to substantial variance, we based our projections on assumptions that yield, in our opinion, conservative estimates of the improvement in Soviet terms of trade. For instance, the following pattern of trade growth in real terms was selected. For Soviet exports, machinery and equipment show no growth during 1982–85; fuels decline by 6 percent in 1982, then grow 0 percent in 1982, 3 percent in 1984, and 0 percent in 1985; non-food raw materials grow by 2 percent, food and raw materials for food by 10 percent, and industrial consumer goods by 4 percent during 1982–85. For Soviet imports machinery and equipment and industrial consumer goods both grow by 5 percent in 1982, 10 percent annually during 1983–85; fuels do not grow during 1982–85; non-food raw materials grow by 2 percent, and raw materials for food grow by 4 percent during 1982–85. Moreover, in order to simplify the presentation by limiting the number of projected exchange rates, the 1980 derived dollar/ruble exchange rates were based on Goldstein (1982) rather than Marrese and Vaňous (1982). This, in turn, leads to marginally lower projections for implicit Soviet trade subsidies than those based on the more complex Marrese-Vaňous methodology.

Two indicators of the improvement in the Soviet trading position within CMEA, if the CMEA price-formation formula is applied uniformly to all commodity categories, appear in Tables 4 and 5. Projections of subsidies to the CMEA Six in current dollars are $18.6 billion in 1981, $15.1 billion in 1982, $13.2 billion in 1983, $12.8 billion in 1984, and $13.7 billion in 1985. Soviet net terms of trade, from a 1980 base of 100, move to 107 in 1981, 114 in 1982, 121 in 1983, 129 in 1984, and 133 in 1985.

The expected dramatic improvement in Soviet terms of trade with Eastern Europe in the early 1980s poses a serious dilemma both for the Soviet Union and Eastern Europe. The Soviet Union realizes that it must cushion Eastern Europe of face the possibility that the deterioration in terms of trade would precipitate a rapid, sharp decline in living standards and the accompanying social unrest. At the same time, the Soviet Union needs higher quality manufactured goods (more competitive with manufactures available in the West). Consequently, the Soviet Union must induce Eastern Europe to offset the rising Soviet export earnings with exports of higher quality manufactured goods.

Given that Soviet assistance will be forthcoming, how can the Soviet Union best employ its aid to stimulate Eastern Europe to improve the quality of its manufactured goods? We envision three possible ways of helping Eastern Europe maintain full employment and respectable growth of national income, each differing with respect to incentive characteristics.

Before these three policy options are discussed, it is important to realize that the 1981-85 projections of Soviet assistance (ruble trade credits plus implicit Soviet trade subsidies) do not change with each case. Because the structure of East Eruopean industry must be changed in order for Eastern Europe to survive politically and economically in its present form, the Soviet Union will be forced to make a long-term commitment, from which noticeable benefits shoud not be expected until the late 1980s.

The first policy option is a continuation of the status quo. This means that the Soviet Union would extend ruble trade credits to cover Soviet surpluses in merchandise trade (see Table 2 for balance of trade projections) while also agreeing to further use of the CMEA price-formation formula (thus, to further implicit trade subsidization). Presumably Soviet decisionmakers would emphasize that the ruble trade credits and the implicit subsidies are being provided in order that Eastern Europe revamps its industrial structure without suffering from excessively painful economic retrenchment. This policy option gives Eastern Europe the greatest possible latitude to reindustrialize, but the only clear incentive to accomplish this is the obligation to repay ruble trade credits. Given the low interest rates attached to these ruble trade credits and some historical precedent of cancelling a portion of such debt, the incentive power of option 1 is low. Moreover, Eastern Europe is under no obligation to repay the implicit subsidies.

The second policy option is to extend loans for specific East European investment projects, where repayment would be a flow of quntities of higher quality goods over time. If option 2 is selected and the CMEA price-formation formula is retained, then the project loans granted in a particular year would equal that year's projected Soviet ruble trade surplus. However, if option 2 is selected, it is more likely that the CMEA price-formation formula would be replaced by a pricing system designed to set CMEA ftps closer to wmps.[8] In our opinion, option 2 would imply such a change because the Soviet Union would perceive a need to demonstrate to Eastern Europe the extent of its financial commitment if it were to exert more direct control over reindustrialization. Assuming that aid in option 2 equals that of option 1, project loans in a given year would equal projected ruble trade credits plus the projected reduction in implicit trade subsidies caused by the introduction of the new pricing system. In either option 2 case relative to option 1, Eastern Europe would provide detailed documentation for each mutually agreed upon project, Thus, with option 2, the Soviet Union would approve of a project-by-project expansion of East European export capacity. In addition, it would have greater certainty about the future real value of its loans. Finally, Soviet pressure for successful economic restructuring would be focused toward a group of individuals associated with each investment project rather than toward a country's entire decisionmaking apparatus, as in option 1. On the negative side, the Soviet Union may not have enough technological information or a sufficiently clear sense of future demand-supply trends to direct East European reindustrialization more ably than Eastern Europe itself.

The third policy option is the most revolutionary of the three. It would require a period of adjustment during which Soviet aid would be used to establish Soviet-East European joint ventures located in Eastern Europe. Once established, these joint ventures as well as all enterprises in Eastern Europe would face relative producer prices equal to the corresponding wmps (thus, the CMEA price-formation formula would be abandoned). Also, the successful implementation of option 3 would require a thorough economic reform, say of the Hungarian variety, throughout Eastern Europe and the Soviet Union. However, domestic consumer prices could continue to differ from domestic producer prices. Repayment under option 3 would depend on the profit-sharing parameters of the joint venture and conceivably could be in both transferable rubles and dollars. On the positive side, option 3 has the strongest incentive characteristics. Yet, it is difficult to imagine that such a revolutionary policy shift would be initiated by Soviet leaders. Uncertainties are numerous: economic reform might lead to unforeseen political shifts; the projected side benefits of economic reform—as evidenced by the Hungarian experience—require many years to come to fruition; and East European population might be resentful on ideological and nationalistic grounds of Soviet economic imperialism.

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[8] Another possibility for the Soviet Union is to shift from transfer of resources through implicit subsidies contained in distorted relative prices to transfer via lump-sum grants under a regime where CMEA ftps are set equivalent to or close to wmps. These grants could be made available for a fixed period of time with gradual scheduled reductions. They would be used for the same purpose as the loans discussed above. The transfer of resources from the Soviet Union to Eastern Europe in the form of lump-sum grants should have a positive efficiency effect on the economic policies of Eastern Europe. Lump-sum Soviet transfers combined with more realistic pricing for Soviet exports to and imports from Eastern Europe (particularly of energy and machinery) would force Eastern Europe to consume imported goods from the Soviet Union according to their true scarcity.

Of the three options open to the Soviet Union, only option 2 coupled with the gradual abandonment of the CMEA price-formation formula appears to lead to a viable long-term solution. Continued use of the CMEA price-formation formula creates seriously distorted price signals. Already incorrect relative prices have severely damaged East European economies. For example, by providing relatively cheap energy exports—in 1981 the Soviet price for oil was 70 percent below and for gas 51 percent below comparable world market prices at realistic ruble/dollar exchange rates—the Soviet Union has encouraged the economies of Eastern Europe (except Romania) to become excessive energy consumers. Compared to Western Europe, Eastern Europe consumes at least twice as much energy per $1 billion of GNP. Even though this is in part caused by a higher relative share of energy intensive industries (metallurgy, machinery, chemicals) in total East European industrial production, a comparison on an industry-by-industry basis typically reveals that energy consumption per unit of identical output in the East runs 50–150 percent above the corresponding energy requirement in the West. By distorting the relative price of energy, the Soviet Union contributed to the vulnerability of East European economies to the high world market energy prices of the 1980s.

IV. POLICY OPTIONS FOR EASTERN EUROPE

By 1985 bilateral terms of trade of individual East European countries with the Soviet Union are expected to decline relative to 1980: 35 percent for Czechoslovakia, 33 percent for Bulgaria and East Germany, 32 percent for Hungary, 31 percent for Poland, and 27 percent for Romania. Hence the deterioration in terms of trade affects each country, indicating that the remarks in this section could be applied to each of the CMEA Six.

The dilemma for Eastern Europe has several elements: how to pay for increasingly costly energy imports from the Soviet Union, how to induce the Soviet Union to continue to provide large-scale financial assistance, how to induce the Soviet Union to maintain and possibly increase the real level of energy and non-food raw material exports to Eastern Europe, how to maintain simultaneously satisfactory levels of exports to the West and domestic supplies while repaying the Soviet Union. Each of these elements point toward a three-pronged policy for Eastern Europe—joint development with the Soviet Union of a broad cooperative economic strategy, increased domestic production efficiency coupled with more effective international marketing, and industrial conservation of fuels and raw materials.

The latter two policies would require the introduction of meaningful economic reform with proper incentives for management and labor to increase efficiency and conserve scarce resources. At the present time, only Hungary is pursuing the type of reform which should eventually lead to a noticeable increase in efficiency and reduction in unit input requirements for energy and key raw materials (particularly those that are imported). As far as the remaining East European countries are concerned, we anticipate that, in the first half of the 1980s, their political leaders will mostly pursue the strategy of "muddling through," with a turn toward more serious reforms after 1985. According to our assessment, Poland will adopt a major economic reform of the Hungarian type in 1983/84, followed by Czechoslovakia in 1984/85. The outlook for Romanian reform is more clouded, because it is unlikely that the present political leadership can bring itself to institute a gunuine economic reform involving significant decentralization of economic and ultimately also political power. The political leaderships in both Bulgaria and East Germany will be less pressed to reform their economies, because the general trend of growth deceleration in Eastern Europe is the least pronounced in these two countries. Nevertheless, these two countries are also likely, in our opinion, to take steps toward a substantive economic reform, probably with a lag of one to two years after Poland and Czechoslovakia.

The above assessment implies that, with the exception of Hungary, we should not expect a pronounced improvement in economic efficiency and a decline in unit input requirements for energy and raw materials within Eastern Europe in the first half of the 1980s. Realistically, the anticipated reforms could have the desired efficiency effect only two to three years after their introduction, i.e., mostly in the late 1980s. This, in turn, increases the potential importance of the first policy—joint development with the Soviet Union of a broad cooperative economic strategy.

It can reasonably be expected that, initially, Eastern European decisionmakers might prefer the preservation of status quo in their countries' trade relations with the Soviet Union. However, this option is not likely to be acceptable to the Soviet Union because it does not provide sufficient incentive to restructure the economies of Eastern Europe and because the Soviet economy faces a less favorable domestic and external economic and political environment in the 1980s than it did during the 1970s.[9]

Given the choice between the two remaining options—accept Soviet loans for specific East European investment projects intended to increase the future capacity for exports of higher quality manufactured goods to the Soviet Union or an establishment of joint Soviet-East European ventures located in Eastern Europe, we believe the East European decisionmakers will strongly favor the former option (the second Soviet option). The reason for preferring the former option is that: (i) it is politically more acceptable than the latter option (the third Soviet option), (ii) it allows East European decisionmakers to shift some of the blame for "austere" policy measures to the Soviet Union, and (iii) it is in their own long-term best interest (rationalization of trade relations with gradual abandonment of the CMEA price-formation formula).

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[9] During the 1970s, Soviet political leadership did not have to be that seriously concerned with the cost of maintaining its "empire" for the Soviet economy was growing at a fairly satisfactory rate and was enjoying advantageous external economic relations. Between 1970 and 1980, the Soviet Union benefited from extremely favorable developments in the country's terms of trade with non-socialist countries, as world market oil prices increased 20-fold, gold prices increased 14-fold, and prices of many other Soviet raw material exports tripled. By contrast, prices of Soviet imports of manufactured goods and grain by only 100–150 imports. In addition, the Soviet Union benefited politically from detente.

Prospects for the Soviet economy in the 1980s are fundamentally different. Soviet national income is likely to grow by at most 3 percent per annum, and more likely at a rate closer to 2 percent. Soviet terms of trade with non-socialist countries are not expected to improve, as most forecasters now conclude that world market energy prices will probably move closely with the general trend of inflation. The mounting burden of defense, as the Soviet Union attempts to maintain parity with the US (or the degree of superiority some allege that it has gained in the 1970s) will force the Soviet leaders to make difficult choices. Finally, the possible end to detente will impose significant political costs on the Soviet leadership.

V. CONCLUSIONS

During the 1960s and 70s the Soviet Union subsidized the economies of Eastern Europe through its exports of energy and raw materials at prices below world market prices (wmps) and imports of East European manufactures at prices above wmps. For 1960–80, the present value of these subsidies in 1980 dollars has been estimated at about $87.2 billion. The changing domestic and external economic and political conditions facing the Soviet Union in the 1980s—slower economic growth in the 1980s compared to the 1970s, no expectations of windfalls in foreign trade from rising prices of oil, gas, gold, and various raw materials on the world market, the possible end of detente—force the Soviet leaders to review their commitment to Eastern Europe and look at the options in Soviet trade relations with Eastern Europe.

We anticipate that Soviet aid to Eastern Europe will gradually decline in real terms from its 1981 peak of $21.1 billion (an equivalent of $2.5 billion in conventional ruble trade credits and $18.6 billion in trade subsidies) to about $17.5 billion in current dollar terms by 1985 (an equivalent of $3.8 billion in ruble trade credits and $13.7 billion in trade subsidies). The key question is the form the Soviet aid to Eastern Europe will take in the future. In this respect, the Soviet leaders face three policy options.

The first option is a continuation of the status quo. However, this option provides the least incentive for Eastern Europe to reindustrialize and gradually increase exports of higher quality manufactured goods to the Soviet Union. Moreover, under this option Eastern Europe is under no obligation to repay the implicit subsidies.

The second option, probably preferred by East European decisionmakers to the third, is for the Soviet Union to extend loans for specific East European projects and repay the loans later with the higher flow of manufactures superior in quality to those currently exported by Eastern Europe. This policy would provide a stronger incentive for Eastern Europe to re-industrialize and is more acceptable to Eastern Europe politically.

The third option is the most revolutionary and hence least likely to take place—to establish joint Soviet-East European ventures located in Eastern Europe. While this strategy would provide the strongest incentive to Eastern Europe to re-industrialize, it would run counter to traditional East European economic nationalism. In addition, it is difficult to imagine that such a radical departure from past Soviet economic policies would be initiated by Soviet leaders.

Finally, Eastern Europe could concentrate on increased domestic production efficiency coupled with more effective marketing strategy for its exports and on efforts to conserve fuels and scarce raw materials. However, these two policies require the introduction of meaningful economic reform with proper economic incentives for management and labor. Currently only the Hungarian economy is moving in this direction. Thus we should not expect any noticeable improvement in this area within Eastern Europe in the first half of the 1980s.

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INTERACTION OF POLITICS AND TRADE: SOVIET-WESTERN INTERACTION

By Marshall I. Goldman*

CONTENTS

		Page
Introduction		117
I.	Trade for trade's sake	118
II.	Politics and trade	119
III.	Trade despite politics	121
IV.	Politics in the West	122
V.	What are the lessons to be learned?	123
VI.	A momentum of its own	125
VII.	The long-run consequences	127
VIII.	Conclusion	128

INTRODUCTION

Many pious words have been written, particularly by businessmen, about the importance of trading for trade's sake. Except at a time of war, trade should be above politics. Using trade as a weapon frequently backfires so that the marksman often ends up wounding not only the victim but himself as well. If that is the case then, so the argument goes, politics should be kept separate from trade. As logical as such reasoning may be, almost no one in the world has been able to resist the pressures to use trade for non-political purposes. Even the Japanese who seemingly are friends with everyone and who have a foreign policy which is intended to offend virtually no one, will occasionally use trade for political purposes as well. In particular, they have attempted to court Middle Eastern and particularly OPEC countries. For that reason, most of their large manufacturers and trading houses refuse to trade with Israel.

If even Japan cannot hold itself aloof from such considerations, it is all but futile to expect the United States and its capitalist allies to ignore politics when dealing with the Soviet Union. After all, the Soviet Union proudly espouses an ideological stance that is openly antagonistic to the ideas, policies, and actions of the capitalist world. Given the bi-polar nature of the relationship, East-West trade, and especially U.S.-Soviet trade, becomes particularly vulnerable to political pressures. Inevitably, each bloc will have strong differences of opinion about the actions of the other bloc. Nor does the pressure flow only from the United States. Both sides use such pressure. Moreover, they both cry "foul" when the other side is doing the using.

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In what follows, we will examine how effective such pressure has been and where such pressures tend to lead.

I. TRADE FOR TRADE'S SAKE

As political as East-West and Soviet-U.S. trade is, there is nonetheless a portion of it that seems to be immune from all but the most extreme political tensions. Thus even during the chilliest days of the Cold War, there was trade between the Soviet Union and the West and even between the Soviet Union and the United States. At first glance it might be assumed that the goods traded in those days were only of the utmost importance. That was hardly the case. Thus in 1954, a year when Soviet trade exports to the United States were at their post-World War II low, out of the 14.2 million rubles worth of goods exported by the Soviet Union to the United States, 6 million rubles of those exports (or over 40%) were furs and 5.4 million rubles consisted of wool. A few years earlier and a few years later, the export list also included some valuable raw materials such as manganese and chrome ore. U.S. exports to the Soviet Union during the height of the Cold War fell to less than one million rubles a year, but even then the Soviets bought and the United States permitted the sale of small machinery items and usually some chemical products. In the late 1950s, on at least two occasions, leather made up over half of American exports to the Soviet Union. It hardly seems like either economy would have ground to a halt without such items.

In more recent times, more crucial commodities have appeared in the export lists of both countries. These items reflect the comparable and in some cases the absolute advantage of the respective regions. Thus since the early 1970s, the Soviet Union has come to buy immense quantities of American grain. Grain usually consists of at least three-fifths of all American exports, even in 1980, the grain embargo year. In exchange, the Soviet Union which sells a much smaller dollar amount to the United States, concentrates on the sale of raw materials such as platinum, palladium chrome, and petroleum. Given the limited sources of supply in the world of some of these minerals, there seems to be good economic reason for at least a minimum level of trade between the Soviet Union and the United States.

The proponents of trade for trade's sake between East and West do not limit themselves only to the sale of goods for which there is an absolute or only strong comparable advantage. In the West those who concern themselves only with economics argue for more trade because of the profits they feel could be made from such exchanges. There are also those in the Soviet Union who advocate trade for non-political reasons. There are many enterprise and ministerial managers who look upon East-West trade as a solution to some production problem. Indeed, not too long before his death Brezhnev criticized the tendency of such managers to seek solutions to their problems by always calling for imports of foreign technology rather than seek solutions from indigenous Soviet technology.[1] These managers are joined by bureaucrats in such places as the Ministry of Foreign Trade to promote trade for non-political reasons because the more trade there is, the more important their jobs become. Obviously they have counterparts in the East European and Soviet sales divisions of Western corporations.

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[1] Pravda, Feb. 28, 1981, p. 6.

II. POLITICS AND TRADE

In recent years as consumption standards have increased and deposits of resources in the United States and the Soviet Union have diminished, the non-political rationale for trade has increased. That does not mean that the role of politics has disappeared. The Soviet Union continues to place politics at the center of its trade policy. After all, Soviet industry and all trade is owned and controlled by the state. In a sense, everything in the Soviet Union is subjected to political considerations since in the USSR, there is no such thing as a private profit motive. While many factory and ministerial managers often have an economic and technical reason for wanting to trade, they like the independent base the private businessmen have in the West. Western private businessmen, at least in the United States, have discovered they have less power to remove trade from political considerations than they thought, but nonetheless the pluralistic nature of Western societies means that there is likely to be more pressure for trade for trade's sake in the West than in the Soviet Union.

Politics became an important determinant of Soviet trade immediately after the Revolution. Contracts were directed to political favorites and to countries from which favors had been extracted or were expected. Trade with Germany, for example, fell as soon as Hitler came to power, but rose again after the signing of the Nazi-Soviet Pact, even though Hitler was still Hitler. After the Nazi invasion, trade with the United States in particular, rose sharply until 1947. Who did what to whom first in the Cold War has been subject to considerable dispute. The fact remains, however, that responding to Stalin's orders, Soviet imports and exports were reoriented from their pre-war suppliers around the world to the newly-communist regions in Eastern Europe and China. Because Germany was divided up it is not possible to be absolutely precise about the extent of the trade reorientation, but roughly 20 percent of the Soviet Union's exports went to what was to become the CMEA bloc (Council for Mutual Economic Assistance) and China in 1913 and 1930, whereas by 1947, Soviet exports to CMEA and China reached 50 percent. By 1950, the figure amounted to 80 percent. The shift in the origin of Soviet imports was equally dramatic.

Undoubtedly, even if Stalin had been more open to the West, after a time he probably would have had trouble finding salesmen, at least in the United States and most of Western Europe, who would have been willing to sell to the Soviet Union. But there is still reason to feel that Stalin deserves more of the blame than Western officials. For example, the Swedes who remained neutral throughout the post-World War II days, did try to trade with the Soviets and did offer credits, but because of Stalin's efforts to cut off contact with all of the West (not only those countries allied with the United States), the Swedes had minimal success.

This autarkic attitude changed markedly after Stalin's death and Khrushchev's rise to power. Khrushchev's desire for trade combined a mixture of both economics and politics. On the economic side, he was determined to improve his people's well-being in a way that Stalin never did. But Khrushchev soon discovered that if the country was to grow more food, it would need more fertilizer. To obtain that fertilizer, the Soviet Union needed a chemical industry, and to build a chemical industry, it needed machinery. As Khrushchev discovered, this machinery would have to come in substantial part from the West because both the Soviet Union and Eastern Europe lacked the capacity needed to build the chemical machinery industry of the magnitude and in the time Khrushchev wanted. To his dismay, however, Khrushchev found that even with imported equipment and with fertilizer, Russia's weather could still be so severe that the harvest might fall to unexpectedly low levels. When the harvest failed under Stalin, Stalin literally let nature take its course. For Khrushchev, this was unacceptable. Rather than allow starvation as Stalin did, Khrushchev decided to import grain from Canada and the United States. Since then, even in good weather, foreign grain imports have become a major component of Soviet imports and are an important aspect of the Soviet Union's foreign economic policy.

Khrushchev also decided to use foreign trade much more actively to advance Soviet political aims. In the post war years, because Stalin had confined his economic interest almost solely to the other communist countries of the bloc, the Russians were relatively inactive economically in Western Europe and in the Third World. Under Khrushchev this gradually began to change. Beginning slowly, the Soviet Union in the mid 1950s embarked on a modest program of foreign aid. Eventually this became a major undertaking. Coincidental with the expenditure of foreign aid funds, the Soviet Union also embarked on a campaign to expand its foreign trade activities with the non-communist world. But because it was an outsider and long absent from the market, the Soviet Union frequently found that the only way it could break its way into established markets was to offer cut-rate prices. This was a natural economic response. But the impact was to undercut long established trading relationships, and to those who now found themselves forced to compete with the Russians, the Soviet competition was often viewed as political, not economic interference, and an effort to undercut the influence of countries like the United States. With the allure of low prices, the Soviet Union began to work its way in to the petroleum markets of Western Europe and Italy in particular as well as into such Third World countries as Cuba, India, Ghana, and Ceylon. In fact, from the Soviet point of view, these were basically not uneconomic deals because in Western Europe at least, the Soviet Union generally obtained payment in hard currency and in goods they would otherwise not have been able to obtain. Moreover, the export of Soviet petroleum products involved almost only soft currency expenditures on the Soviet part so that the opportunity cost in hard currency for the Soviet Union was actually zero or at least rather modest. But whether such transactions were profitable or unprofitable, there was no doubt that they were politically useful. In the Third World such commercial and foreign aid transactions served to pave the way for important political contacts. In the traditional sense, the flag followed on the heels of this commerce and in the case of Cuba at least, the Soviet Union made substantial political inroads into the Western hemisphere.

There can be no doubt that when the Soviets determine that the politics of a relationship are more important than the economics, the politics will prevail. This is well illustrated by the many instances where the Soviets have entered into barter arrangements for Third World commodities for which it did not have a serious need. In particular, it has ended up with quantities of dates, sugar, and coffee that were almost always purchased as a political not an economic act. In a more dramatic way, politics have caused the Soviet Union on several occasions to abrogate valid commercial contracts. Thus the Sov-Rom Oil Company which the Soviet Union controlled, refused to deliver petroleum to Yugoslavia in 1948 when Tito began to assert his independence. Similarly, the Soviet Union halted the sale of petroleum to Israel after the invasion of the Sinai; it did the same to Finland after the Finns moved to elect an anti-Soviet President in 1958. China in 1964 and even Cuba in 1968 had their petroleum cut off when they refused to follow the Soviet line. Soviet trade officials who assert that the Soviet Union does not break contracts are engaged in disinformation.

III. Trade Despite Politics

While politics in the Soviet Union often override economic considerations, that is not always the case. There are some dramatic illustrations in U.S.-Soviet trade where the Soviet Union simply swallowed its political pride because of its economic needs. One of the best examples is the way the Soviet Union took advantage of the 1973 Organization of Arab Petroleum Exporting Countries (OAPEC) oil embargo to sell to the embargoed Netherlands and the United States. There was no doubt about whom the Soviet Union supported politically at the time. However, the Soviet Union could not resist the windfall profits when the price of oil rose four-fold or more in the spot market.

In the same way Soviet leaders decided to go ahead with their invitation to President Richard Nixon in May 1972 despite the fact that only a few weeks before, Nixon had announced the bombing of North Vietnam and the blockade of Haiphong Harbor. This was a step clearly upsetting to the Vietnamese who looked to the Soviet Union for their main logistical and political support. The explanation for the hypocrisy was that in the spring of 1972, the Soviet Union had come to realize that it was in great need of American grain. It was also eager to avail itself of American technology. The May meeting between Nixon and Brezhnev paved the way for the Great Grain Robbery in the summer of 1972 and the U.S.-Soviet Trade Agreement later that year. In the Soviet scheme of things, the toleration of the escalation of U.S. violence in Vietnam was an unfortunate part of the price the Soviet Union was prepared to pay to obtain the American imports it needed.

On occasion politics takes a backseat even when it comes to exports. Thus because it has found itself in need of increasing amounts of hard currency, the Soviet Union has found it expedient to export products that normally it would have preferred to have kept at home. Thus the Soviet Union has exported titanium sponge, even though titanium has very important strategic significance. Ironically the United States bans the sale of titanium to the Soviet Union even though they sell it to us. In a sense, the Soviet need to earn the hard currency which the sale of such strategic items makes possible, suggests that at times, the Soviets are prepared to sell us the rope we may someday use to hang them.

IV. POLITICS IN THE WEST

The Soviets are not the only ones who at times have found it expedient to disregard contractual commitments. When viewed from the Soviet side, the West, and particularly the United States, must be regarded as especially unreliable. While the German decision not to build a gas pipeline in 1963 is an example where the Europeans have changed their minds after arranging an agreement with the Soviet Union, there are many more examples involving the United States. Of course most American exporters to the Soviet Union have had to apply for licenses for their products since the Export Control Act of 1949. But the serious breaking of commitments, at least from the Soviet perspective, probably begins only in late 1974 and 1975. That marks the U.S. decision to hold back Most Favored Nation status (MFN) for the Soviet Union until it began to allow a high enough level of emigration. This stipulation had not been included as part of the original U.S.-Soviet Trade Agreement of 1972. Under that agreement, the Soviet Union promised to pay back a fraction of its past Lend-Lease debt and accept other conditions in exchange for which it would be given MFN tarrifs. By subsequently insisting in the so-called Jackson-Vanik Amendment, that no MFN status would be allowed until the Soviets also agreed to allow Jews and others to emigrate each year, the United States in Soviet eyes had unilaterally changed its contractual commitment. This meant that Soviet exports would have to bear the higher tariff charges of the 1930s, which tended to make their exports uncompetitive in the American market. But holding back MFN status was not the only limitation. With the passage of the Jackson-Vanik Amendment, the U.S. Congress passed another law which restricted the amount of credits available to the Soviet Union through the Export-Import Bank. Under the so-called Stevenson Amendment the Soviet Union was limited to borrowing $300 million over a four year period of time unless Congress specifically acted to increase the limit. This too came as a surprise to the Soviet Union. There are some who argue that the Soviet Union had always been more interested in obtaining Export-Import Bank credits than MFN status. On both counts, however, the Soviets saw these new laws as a change from what had been originally promised.

Thereafter, the United States began to intervene with what seemed to be increasing frequency in contract negotiations with the Soviet Union. For instance, after it became clear that the Soviet Union had suffered another bad harvest in 1975, worse than that of 1972, many U.S. officials became concerned that the Soviet Union would repeat its 1972 sweep of the U.S. grain markets. To insure that the Soviets would not again be able to do all their buying at low prices and leave the higher prices for American consumers, the U.S. government under President Ford declared a temporary trade embargo on grain exports. This was not intended as political punishment for some human rights violation. Instead, the decision to prevent the completion of grain delivery contracts was made primarily for economic reasons. In the same way, the Japanese, presumably one of our closest allies, were also caught up in this embargo and prevented from taking delivery on soy beans they had already purchased.

After the precedent of the 1975 embargo, the United States government seemed to intervene with increasing frequency. Thus in the summer of 1978, after a Soviet court found Anatoly Shcharansky guilty of among other things helping U.S. intelligence, the United States instituted strict licensing regulations over the export of petroleum technology and prevented the delivery of already-promised equipment. The arrest of J. Crawford, on June 12 of the same year, only heightened the degree of control. It was more than coincidence that on September 7, 1978, the day Crawford was released, the United States government reversed itself and quietly announced that it had approved the export of the Dresser drill bit plant that the Soviets wanted so badly.

The next set of embargoes followed the Soviet invasion of Afghanistan when in January 1980, the United States government announced a grain embargo on grain sales exceeding eight million tons. The United States also revoked export licenses for most technology sales to the Soviet Union. Although the grain embargo was removed by President Reagan in April 1981, licensing controls over certain forms of technology were reinstituted after the Soviet intervention in Poland became unusually heavy-handed. Among other contractors, General Electric found itself prohibited from delivering components for gas pipeline compressors.

V. WHAT ARE THE LESSONS TO BE LEARNED?

Looking back over this rather hectic period, it looks as if politics has become a very important consideration in our economic relations with the Soviet Union. Probably the only way to eliminate politics would be to eliminate trade. This explains at least in part why the American reaction to Soviet interference in Poland seems to be so much more pronouned than it was to the much more violent acts of the Soviet Union during the invasion of Hungary in 1956 and Czechoslovakia in 1968. In the earlier instances, other than words, there was no way the United States could demonstrate its anger. By the time the Polish crisis began, however, American companies had entered into a substantial trading relationship with both Poland and the Soviet Union. U.S. exports to the Soviet Union in 1975 amounted to $3.6 billion. Even after the cutback following the invasion of Afghanistan in 1980, American exports to the Soviet Union still totalled over $1.5 billion. Exports to Poland in both years were over $700 million. In contrast, American exports to the Soviet Union in 1967 were a mere $60 million and $19 million to Czechoslovakia. There was almost no trade in 1957. Obviously it is impossible to declare an embargo on trade when there is no trade. In contrast, once trade builds up, it becomes all but impossible to go about business as usual if the trade partner commits what is viewed as a particularly immoral act. In an extreme case, war can be declared. But since Soviet aggression usually involved transgressions against a third party, there is unlikely to be enough moral outrage to provoke the United States into declaring war. A disruption of trade is a more meaningful reaction than war, and it also serves therapeutically to assuage some of the outrage Americans feel. Admittedly an economic embargo may still not be a strong enough action for some. In any case, for the United States, which often takes its moral outrage seriously (at least when it sees the Soviet Union interfering in other countries' affairs), an economic embargo is certainly better than "going about business as usual." [2]

But while trade can and has been used as a reward for good behavior, turning trade flows off and on or fine-tuning as some call it, is not always as easy as some policy planners would like to think. In other words, the lever which it is hoped will influence Soviet behavior once put in place, just as often turns out to have an influence on American behavior. The best example is the grain embargo. Those who look beyond the profit advantages that were to come from selling grain to the Soviet Union argued that any arrangement which caused the Soviet Union to appeal to the United States for a good portion of its grain would serve to restrain Soviet aggression. Indeed, for a time it seemed to do just that. What was not so clearly understood, however, was that once the Soviets had become dependent on buying such large quantities of grain, American farmers would allow themselves to become equally dependent on selling to the Soviet Union. Excited by the prospects, the farmers expanded their crop potential to take advantage of the opportunity. The general prosperity such large sales seemed to promise set off an expansion of farming activity and an increase in land values. Unfortunately, once the magnitude of such sales to the Soviet Union was cut back, the lower demand for grain brought about lower agricultural prices which in turn left many farmers holding more land than they could pay for. This decline in prices coincided with record high interest rates. Together this has led to a liquidity crisis across much of the Midwest which threatens not only the farmers, but their bankers. No wonder there is such a clamor every time there is a hint of the reinstitution of another embargo. The United States finds itself virtually entrapped by its own lever. Not surprisingly, senior American senators from the farm belt all but demanded President Reagan not only allow the sale of U.S. grain to the Soviet Union, but that he should actively seek to promote such sales.[3] To make the reimposition of a grain embargo even less likely in the future, the farm lobby has managed to pass legislation which requires that no grain embargo can be declared in the future unless almost all other exports are also embargoed. As a result, it is virtually impossible for the United States to declare subsequent grain embargoes. This means that we have now been denied what has probably been the most effective tool in our nonmilitary aresenal.

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[2] That is not to say that we in the United States would like to have others penalize us in the same way. For example, Americans would probably have been ununderstanding if Western Europe or even the Soviet Union had declared a trade embargo on the United States because of our activities in Vietnam.

[3] The New York Times, Apr. 17, 1982.

Much the same type of phenomena has occurred in almost all the other economic sectors which have become involved in East-West trade. Some industrial executives, having had a bad experience, have now decided that once was enough for them. Other corporations, which despite their problems continued to seek Soviet contracts, have found that it has become very hard to readjust if the Soviets divert their business elsewhere. In some instances that is because they have expanded their capacity to satisfy Soviet needs. The Mannesmann Steel Company in Germany, for example, has been making large diameter steel pipe intended almost solely for Soviet pipelines. Thus if the Soviets don't buy their pipe, the company will face unemployment and idle capacity. In other cases, when American licenses have been withdrawn, American businessmen must stand by in frustration as Soviet contracts go by default to foreign competitors. Similarly, American as well as other Western bankers have come to find themselves in a very awkward predicament when the Poles and subsequently the Romanians, Hungarians, and even the Soviets themselves have begun to fall behind on the repayment of their bills and loans. When faced with the prospect that the Poles might default on their debt, many Western bankers, but certainly not all, have come to find themselves the victim of their own leverage.

Some Western governments have consciously supported and promoted East-West trade even though they were aware of the possibility of such default. France, for example, for many years actively subsidized bids from French industry and banks in order to win contracts. As the French government saw it, it was cheaper to finance such contracts in the East and thus assure employment for the West, rather than face the political risk of unemployment and the economic cost of unemployment compensation at home. In effect, some countries have been sponsoring massive public works projects with the resulting products destined for East European rather than home markets.

VI. A MOMENTUM OF ITS OWN

Not surprisingly, once East-West trade begins, the process often seems to take on a momentum of its own. Economic and political motives become entangled. A particularly poignant example of that was the attempt to use the bait of Most Favored Nation status for the Soviet Union in an effort to coax the Soviet Union into removing its barriers for some perspective emigrants. While the effort was designed to encompass all nationalities, and indeed included many Soviet Germans and Armenians, the bulk of those affected were Jews. Overall, the effort was unexpectedly successful. Given the long-standing refusal of the Soviet Union to allow anything more than a few hundred emigrants a year, it was a triumph of political pressure that from 1971 to 1981, the Soviet Union reversed its course and allowed a quarter of a million people to leave.

The campaign to induce the Soviets to relax what had been a virtual emigration ban was orchestrated by Senator Henry Jackson and Congressman Charles Vanik. Both men put together an unlikely alliance of liberals, conservatives, trade union officials, Jews, and anti-communists. This coalition would have found it hard to agree on anything other than the Jackson-Vanik Amendment. The Amendment meant that Soviet products would be subjected to higher tariffs than similar products coming from competing nations. It also meant that the Soviet Union would be unable to borrow money from the Export-Import Bank at low interest rates.

As we saw, the Soviets were eager to obtain both MFN and particularly subsidized credits. Thus despite considerable nastiness, they allowed the emigration figure ultimately to rise to 51,000 Jews a year. When to this is added the Germans and Armenians, the total in 1979 was approximately 60,000, a goal long sought by Senator Jackson. Soviet authorities tightened the qualifications for emigration in May 1979 by requiring that thereafter only first degree relatives, that is siblings, or parents or children, could leave for the purpose of being reunited with their family members. Nontheless, despite the more rigorous rules, the number of emigrants continued to grow. The record high was reached in October when 4,746 were allowed to leave, more in one month than in the whole of 1970-and at the present rate, 1982.

Unfortunately this responsiveness of the Soviet Union was not reciprocated. Those interested in emigration made a critical mistake: they did nothing. It was clear that the Soviet Union was anxious to improve relations. It wanted a Salt II Treaty and it also wanted credits and MFN status. And despite the fact that by mid-1979 there were increasing sources of friction between the two countries, there were nonetheless some reasons for optimism. Brezhnev and Carter met in Vienna and spoke promisingly of a Salt Agreement. In the Congress, there were hearings and serious discussions about recommending a package deal that would extend MFN status for China and the Soviet Union. Given the surge in emigration, those groups supporting the Jackson-Vanik Amendment should have come out publicly and announced their support for MFN status for the Soviet Union. However they did not. In fact, when the American Jewish Congress, a member of the coalition supporting the Jackson-Vanik Amendment, indicated in testimony to Congress that this might be a time for more flexibility, they were attacked for breaching a solid front. Congressman Vanik was also criticized when he began to move away from his original stance. In effect, the coalition was caught up in his own momentum and fearful that if it said nice things about the Soviet Union, it would lose powerful allies that it might need in the future. Moreover, it is never easy to say anything nice about the Soviet Union.

In the end, despite the Soviet Union's show of good faith, no action was taken on Most Favored Nation status for the Soviet Union. Even worse, in 1979, the United States decided to extend MFN status to China, effective February 1980. It was difficult to know what might have been, but it is clear that the decision to extend MFN to China and not to the Soviet Union was seen by the Soviets as a breach of good faith if not betrayal. Soviet leaders can be forgiven for sensing they had been tricked. It was all quo and no quid.

At this point the Soviets had nothing to gain and more important, nothing to lose. We will never know if the decision to invade Afghanistan would have been made quite so readily if the Soviets had more at stake. A good case can be made that the invasion would have taken place no matter what American economic policy would have been, but since the open invasion by Soviet troops was such an atypical action (usually the Soviets send surrogates from Cuba or East Germany), there is enough reason for doubt. In any case, we should learn for the future that policy actions which make sense at one point do not necessarily make sense forever. The problem is that it is not easy to find policies that permit flexibility. Such flexibility is necessary, however, because there are times when, as distasteful as it may be, it is necessary to reward our adversaries. That is hard to do, but failure to be flexible may cause our policy to backfire as it apparently did in the instance of the Jackson-Vanik Amendment.

VII. THE LONG-RUN CONSEQUENCES

Each time an economic weapon is used for political purposes, there is a long-run cost, not only to the intended victim, but to the user of that weapon. We can call this the "Iranian Syndrome." The decision of the American government to confiscate Iranian assets in American bank branches and subsidiaries caused all the OPEC nations to move some of their assets from American bank control for fear that they too might someday become victims of a similar action. As a result, the United States can no longer use this tool as effectively as it once did. Similarly, use of the grain embargo was effective the first time, but by the second embargo, the Soviet Union had already found alternative sources of supply. Thus Brazil and Argentina have moved aggressively to increase their agricultural capabilities in ways they had shown no interest in before, and thus they have now become much more competitive with the United States not only in the Soviet Union, but elsewhere in the world. Moreover, American farmers now have become much more sensitive to the use of the grain weapon, and as we saw, have virtually eliminated its use in the future. In the same way, after the declaration of an embargo and the shipment of compressors for gas pipelines and equipment for petroleum production, the Soviet Union has sought alternative sources of supply outside the United States and has increased its efforts to produce comparable generators and pipe-laying equipment at home. Henceforth the Soviet Union can be expected to do all it can to avoid the embarrassment of an American embargo and the disruptions such embargoes cause to its economy.

Nor are the Soviets the only ones affected. Many American companies which have entered into U.S.-Soviet trade have been badly scarred. They have incurred negotiating and contract, and in some cases even production, costs for projects that were aborted. Moreover, there is no one who will reimburse those costs for them. For some, these costs have amounted to millions of dollars. Conceivably, if relations improve someday, these companies might once again be tempted to join in, but for many it has been too risky and too expensive.

VIII. CONCLUSION

A decade has passed since President Nixon flew to Moscow in May 1972 and returned with great expectations. Few of those expectations have been completely realized. Looking back on that experience, what have we learned?

The first lesson is that we should hold our expectations in check when we embark on a trading relationship with the Soviet Union. By dealing with an ideological and strategic opponent like the Soviet Union, there are bound to be too many sources of friction and disappointment. Inevitably there will then be calls for retaliatory action and it will be hard to avoid using trade as the the main club. When we convert what started out as a lever into a club, we should be careful to ask ourselves what we expect the long-run results of our retaliation to be. In the passion of the moment, that is hard to do, but such actions become counter-productive if after a year or so, for example, a grain embargo is lifted without obtaining anything in exchange. We should design our policy so that we determine in advance not only when we will apply such sanctions, but when we should lift them. This takes not only forethought, but political determination. As we saw when the Soviets finally did comply with the sense of the Jackson-Vanik Amendment, the American proponents of the Jackson-Vanik Amendment found themselves locked in by their own domestic political restraints and thus unable to respond to Soviet initiatives. We know the threat of withholding MFN had a significant impact on the release of over a quarter of a million emigres. We will never know what a more responsive policy by the supporters of the Jackson-Vanik Amendment might have led to. What is clear now is that the use of American trade as a political weapon in dealing with the Soviet Union has proven to be a double-edged sword inflicting damage on the user of the sword as well as on the intended victim.

SOVIET INVESTMENT POLICY IN THE 11TH FIVE-YEAR PLAN

By Robert Leggett*

CONTENTS

		Page
I.	Summary	129
II.	Introduction	131
III.	Soviet investment policy	131
	A. Strategy in the 1960s and 1970s	131
	B. Strategy in the 1981-85 Plan	132
IV.	Investment allocations in the 1981-85 plan	136
V.	Consistency of investment and production plans	138
	A. Trends in ICORs	138
	B. Prospects for ICORs	140
VI.	Coping with the investment squeeze	142
	A. Reduced level of unfinished construction	142
	B. Lower retirement rates	143
	C. Imports of machinery and equipment	144
	D. Better planning and management	144
VII.	Intensified debate over investment policy	145

I. SUMMARY

Rapid growth of new plant and equipment outlays has always played a key role in the Soviet Union's strategy for promoting economic growth. In the latter half of the 1970s, however, growth in capital investment slowed markedly. The reasons for the slowdown include:

—Bottlenecks in sectors that provide key investment inputs such as steel and construction materials.

—A decision to maintain the primacy of defense spending against a background of tightening resource constraints.

—The leadership's apparent conviction, dating from the mid-1970s, that more and more investment was too costly a way of sustaining economic growth.

The decline in investment growth is slated to continue in the 1981-85 plan period. The investment increase targeted—10.4 percent over 1976-80—is by far the lowest in the post World War II era. Achievement of the growth in GNP and its component sectors implied by the 1981-85 plan therefore depends critically on substantial increases in capital productivity. Indeed, increasing the efficiency of capital investment is one of the central national economic goals. The upward trend in the amount of capital per unit of output of goods and services (capital-output ratios) in the 1970s stands out as the dominant feature of the recent slowdown in

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Soviet economic growth and the source of much of the leadership's difficulty in arriving at decisions on resource allocations.

Moscow's chances of substantially boosting capital productivity during the current plan period are remote. The cornerstone of Soviet investment policy, as laid out at the 26th Party Congress in February 1981, is increased emphasis on replacement of machinery and equipment and the renovation of existing structures rather than investment in new construction. There is, in fact, little new in this policy, which aims at modernizing Soviet capital and using it more efficiently. It has been repeatedly promulgated in past Five-Year plans but never successfully implemented. The systemic reforms that might permit such an investment strategy to be effectively carried out are not likely to be instituted.

The pattern of investment allocations called for in the 1981-85 Plan also is likely to be a drag on overall capital productivity. The plan lacks balance. It stresses development of fuels and energy—apparently at the expense of other sectors, many of them also vital to economic growth. The projected distribution of investment suggests that Moscow has still not devised sound criteria for allocating investment, even though the need for improved planning and management of investment has become more urgent in the face of an impending reduction in the share of investment in GNP.

Without some major improvement in capital productivity, the industrial output goals of the 11th Five-Year Plan are unattainable. As measured by a steady rise in incremental capital-output ratios (ICORs) in industry, capital productivity has been declining for several years. Most of the industrial production and investment targets for 1981-85 imply a reversal of this trend. Given the dim prospects for greater efficiency, however, and the continuing upward pressure on capital-output ratios, a reversal of ICOR trends seems virtually impossible.

Nor can the Soviet capital stock be significantly augmented by other means such as putting more plant and equipment into operation by reducing the huge volume of unfinished construction, lowering retirement rates, and buying more machinery abroad. Unfinished construction has, with the exception of 1980, steadily mounted, and the systemic shortcomings that have defeated repeated attempts to arrest the upward trend are not likely to be eliminated. Retirement rates are already extremely low—so low, in fact, that they impede efforts to increase efficiency. The USSR's tight hard currency position restricts Soviet purchases of Western machinery, for which stepped-up imports of less technologically advanced East European machinery would be a poor substitute.

On balance, then, the slowing rate of investment growth and the declining rate of return on investment are likely to reinforce other economic factors impeding economic growth in the 1980s. Investment strategy seems certain to be a central topic in academic and professional debate, and probably in political circles as well. Criticism of the current strategy has already begun in the USSR, in some instances in leading Soviet publications and by prominent economists. Doubts have been expressed not only about the distribution of investment in 1981-85 but about the validity of the assumption that higher productivity of investment is compatible with reduced growth in investment.

II. INTRODUCTION

During the 1981-85 Plan Period the USSR is counting on a rise in capital productivity to offset the decline in investment growth. The key questions treated in this paper are whether the policies by which the Soviet Union intends to improve the efficiency of capital investment will work and, therefore, whether the plan production targets, particularly the industrial goals, are realistic.

This paper first describes Soviet investment strategy during the 1960s and 1970s and considers investment policies laid down for 1981-85. After an analysis of the planned allocations of investment, the consistency of industrial output targets and investment plans is discussed. Finally, the paper explores the options open to Soviet policymakers in dealing with the investment squeeze and reviews the evidence that a vigorous debate is under way in the USSR over investment policy.

III. SOVIET INVESTMENT POLICY

A. STRATEGY IN THE 1960S AND 1970S

In the postwar period the USSR has relied primarily on massive injections of labor and new plant and equipment to support economic growth. Total gross fixed capital stock in the USSR more than quadrupled between 1960 and 1980 (table 1). Soviet planners relentlessly pushed the expansion of capital assets by allocating a large and rising share of resources to capital investment, holding retirements to a minimum, and prolonging the service lives of technologically obsolete plant and equipment through repeated major repairs. In addition, past Soviet investment has tended to emphasize the creation of new facilities rather than the renovation of existing enterprises. As a result, the bulk of new fixed investment during the period was channeled into buildings and structures rather than into new machinery and equipment, although machinery and equipment are the principal carrier of new technology.

TABLE 1.—USSR: GROSS FIXED CAPITAL IN THE ECONOMY AND IN SELECTED SECTORS (END OF YEAR)

	Billion rubles, 1973 prices		1980/1960
	1960	1980	
Total [1]	398	1,744	4.4
Productive fixed capital [1]	226	1,149	5.1
Industry	100	551	5.5
Agriculture [1]	54	238	4.4
Nonproductive fixed capital	172	595	3.5
Housing	120	339	2.8

[1] Including livestock.

Note: The Soviets break down fixed capital (osnovnye fondy) into "productive" and "nonproductive" capital. In Marxist parlance, productive capital is used directly in the production process. Nonproductive capital includes capital in the housing and municipal services sector, in organizations and institutions of public health, education, science, culture, and art, and in administrative organs.

Source: CIA Research Aid Sov 82-10093 (U), August 1982, Soviet Statistics on Capital Formation.

In the latter half of the 1970s, however, Soviet planners opted to reduce sharply the rate of growth of new fixed investment—the first major indication that the much talked about transition from "extensive" to "intensive" development would be enforced.[1] Capital investment, which had grown at an average annual rate of 7 percent in 1971-75, slowed to an average annual rate of 3.4 percent in the last half of the decade. The leadership probably pared investment growth because it wanted to increase the priority for consumption while maintaining the primacy of defense spending. At the same time, many Soviets officials were concerned that the steady rise in capital-output ratios dating from the early 1960s demonstrated that simply relying on more and more investment to sustain economic growth was too costly.

Most of the growth in investment during 1976-80 was concentrated in the first three years of the plan period. Growth averaged about 5 percent a year in 1976-78, but only about 1½ percent in 1979-80. The slowdown in the latter two years of the plan could reflect an attempt to adjust for more-than-desired investment in the first three years. However, it was more likely associated with the emergence in the late 1970s of bottlenecks in the production and distribution of such key investment inputs as steel and construction materials. The persistence of these bottlenecks helps explain the further reduction in planned investment growth in 1981-85.

B. STRATEGY IN THE 1981-85 PLAN

In devising an investment strategy for the 1981-85 plan, Soviet planners confronted an array of deserving petitioners:

—Because of declining growth in energy production, particularly coal and oil, huge investments had to be allocated to the exploration and exploitation of energy sources, particularly in West Siberia where large investment expenditures are needed in infrastructure as well as in producing fields.

—Subpar performance in the ferrous metals industry—stemming from inadequate past investment in certain key areas—required heavy outlays in that sector.

—Hobbled by years of neglect, the Soviet transportation system is unprepared to meet the increasing demand for services. Major investments in new roads, inland waterways, rail lines, and rolling stock seemed necessary.

—Despite the huge sums spent on agriculture under Brezhnev—agricultural investment now accounts for 27 percent of total investment[2]—the leadership continues to perceive a strong need for investment in this sector.

—Advocates of consumer-oriented programs argued for a larger share of investment—notably for the modernization of light industry and housing construction.

Meanwhile, capital-output ratios have been steadily rising in all major sectors of the Soviet economy and in most branches of industry, adding to the allocation problem by increasing the demand for investment. The capital-output ratio for the overall economy, for example, more than doubled between 1960 and 1980 (table 2). A number of factors have been responsible. There has been a shift to more capital-intensive forms of production in order to conserve labor and fuel. Minerals, fuels, and raw materials are found in more inaccessible regions of the country. Systemic deficiencies such as the lack of effective control over investment projects and inefficiencies in construction work have also contributed to the rise in the ratio. Construction time, for example, is extremely long in the USSR, and construction norms are often exceeded by significant margins. According to a Soviet economic journal:

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[1] That is, from reliance on rapid increase in inputs to much greater emphasis on more efficient use of inputs and technological progress.

[2] This includes capital investment in state and collective farms—both productive and nonproductive investment—as well as expenditures for the construction of agricultural repair enterprises, scientific-research institutions, construction-related enterprises of the Ministry of Land Reclamation and Water Resources, enterprises for the processing of agricultural products, and other similar expenditures for the development of agriculture. This concept of agricultural investment is presented by the Soviets under the rubric "agriculture—entire complex of works." For an in-depth discussion of Soviet published statistics on agricultural investment, see CIA Research Aid SOV 82-10093, August 1982, Soviet Statistics on Capital Formation.

> Construction time for large industrial projects is 5-10 or more years and 3-4 years for medium-sized projects. This is much longer than the construction time in the United States and other developed countries where large enterprises in ferrous metallurgy are built in less than 24 months and while enterprises in the majority of other branches are built within a year. The project planning time (frequently 2-3 years or more) and the time required to reach the technical and economic potential of newly activated production capacities are excessively long at the present time. As a result, when a new or rebuilt enterprise begins operating at full capacity it is already technically obsolete. This is not surprising when we consider the modern tempo of scientific and technical progress.[3]

TABLE 2.—USSR: CAPITAL-OUTPUT RATIOS

	1960	1965	1970	1975	1980
Total economy	1.6	1.9	2.2	2.7	3.3
Industry	1.5	1.9	2.1	2.4	2.8
Ferrous metals	2.2	2.5	3.0	3.5	4.5
Fuels and power	3.1	3.4	3.8	4.1	4.8
Machinery	0.9	1.1	1.3	1.5	1.8
Chemicals	1.9	2.5	2.9	3.1	3.9
Agriculture	0.6	0.8	1.0	2.0	2.9
Transportation and communications	3.1	3.1	3.2	3.4	4.0
Construction	0.4	0.6	0.8	1.0	1.3

Sources: Ratios were constructed by dividing values of gross fixed capital stock found in CIA Reference Aid, Soviet Statistics on Capital Formation, by values of output found in CIA GNP accounts, unpublished.

After weighing all the competing demands for investment allocations and reviewing the resources available to them, the leadership decreed a further slowdown in the growth of new fixed investment. The original 1981-85 Plan targeted an increase of 12-15 percent in total new fixed investment for the five-year period over the last half of the seventies. The goal was revised downward to 10.4 percent by President Brezhnev at the November 1981 meeting of the Supreme Soviet, at least partly on the grounds that investment resources were still out of balance with investment plans. (Figure 1)

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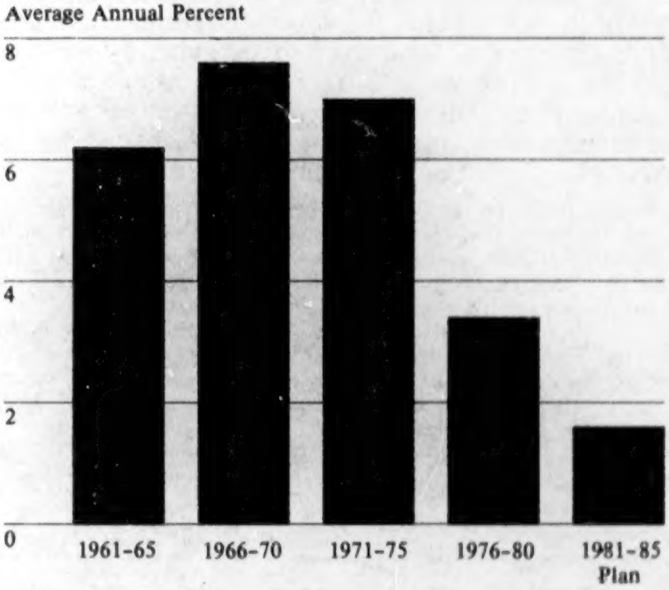
[3] T. Khachaturov, "Puti povysheniya effektivnosti kapital'nykh vlozheniy," Voprosy ekonomiki (July 1979), pp 120-133.

Figure 1
USSR: Growth in Gross Fixed Capital Investment



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To justify the gamble it is taking, the regime is counting on an upturn in capital productivity. Increasing the efficiency of capital investment has been singled out as one of the central national economic goals of the 1981–85 Plan. As Gosplan Chairman Baybakov put the issue in his November 1981 speech to the Supreme Soviet:

> For the first time in the practice of national economic planning, the planned growth of national income exceeds the planned growth of capital investment. This requires fundamentally new approaches to the distribution of capital investments and organization of construction. Chief attention must be devoted to increasing the effectiveness of capital investments and better coordinating capital construction with the material and technical resources and potential of construction and installation organizations.

The investment strategy hammered out at the 26th Party Congress in February 1981 depends first of all on getting better control over construction work. Detailed lists of all construction projects—both new construction starts and reconstruction—are to be assembled, approved by appropriate authorities, and rigidly adhered to over the course of the plan. The plan for construction projects is to be consistent with available construction materials, labor resources, power-generating equipment, financial resources, and with the existing capabilities of construction and installation organizations. To speed up construction work, payment for construction work will not be made until a project is completed, and up to 0.5 percent of the estimated cost of construction and installation work is to be credited to the participating organizations for each month that construction is finished ahead of schedule. In addition, construction worker bonuses are to be predicated on the volume of construction and reconstruction work completed.

The dominant theme of Moscow's investment policy, however, is the increased emphasis on renovating and reequipping existing facilities. That is, a larger share of investment is to go for machinery and equipment and less for buildings and other structures. About half the increase in ferrous metals output during 1981–85, for instance, and approximately 85 percent of the increment in machinery output are to result from renovation. Soviet planners claim that renovation is advantageous because it (1) involves mainly new machinery and equipment and relatively little expensive construction work, (2) accelerates the withdrawal of old technology from production processes and hastens its replacement with new, resource-saving technology, and (3) shortens construction time.[4]

This approach is not new. The Soviet leadership has long stressed the importance of renovation and reequipping at the expense of new construction for many years. Nonetheless, Professor Stanley H. Cohn estimates that the share of equipment in the Soviet capital stock increased by only one percentage point between 1958 and 1977.[5] According to data published by the Scientific Institute of Gosplan, in the 1970s the share of equipment in the industrial stock of fixed capital increased from 39.2 to only 39.8 percent.[6]

Boris Rumer, among others, has examined the reasons for the failure of the renovation and reequipping strategy.[7] He found that:

—The replacement of machines often requires extensive and expensive remodeling, reengineering, and even the expansion of existing facilities. This is especially true in the European parts of the country where the Soviet industrial plant is much older and is situated in densely populated areas.

—The Soviet "investment complex" (machine-building industries, construction enterprises, and design organizations) has been ill prepared and poorly motivated to sustain the policy. Design enterprises, for instance, tend to concentrate on designing new enterprises because standard construction projects are much easier and more profitable. Also, the machine-building industry prefers to manufacture serial, standardized equipment rather than machines to fit the specific conditions and dimensions of an enterprise under renovation.

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[4] According to the Central Statistical Administration, the rate of return on reconstruction investment is 1.5 times larger and leadtimes 27 percent lower than on new construction. See David A. Dyker, "Planned and Unplanned Investment Patterns in the 1980's," paper delivered at Colloquium on the CMEA Five-Year (1981–85) Plans in a New Perspective: Planned and Nonplanned Economics, NATO, Economies Directorate, 1982, p. 17. For a further discussion of this issue see Peter Davies, "Soviet Union: Capital Investment 1960–80 and Plans for 1985," Research Memorandum, unpublished, pp 25–30.

[5] Stanley H. Cohn, "Soviet Replacement Investment: A Rising Policy Imperative," "Soviet Economy in a Time of Change," compendium of papers submitted to the Joint Economic Committee, 96th Congress, 1st Session, Volume 1, 10 October 1979, p. 234.

[6] V. Kremyanskii, "Izmenenii stoimosti stroitel'stva," Voprosy ekonomiki, No. 10 (October 1981), pp. 52–64.

[7] Boris Rumer, "Soviet Industrial Investments: Problems of the 1981–85 Plan," The National Council for Soviet and East European Research, Washington, D.C., June 10, 1982.

—Both the contracting enterprise and the construction firm prefer expansion to renovating or reequipping. Renovation interferes with production activity and can therefore jeopardize output goals and cut worker and managerial bonuses. Construction enterprises would rather expand existing facilities because they find it easier to work on open building sites and they can report a larger volume of work, enhancing their plan fulfillment record.

In any event, expansion often amounts to new construction, because both additions to existing structures and new enterprises built adjacent to existing facilities are frequently reported as expansion. The ability of construction organizations and their customers to thwart the will of the central authorities on investment policy is probably in large measure a reflection of the difficulty of monitoring myriad construction sites in a vast country. The evasion process may be aided by the failure of the statistical authorities to distinguish among expansion, renovation, and technological reequipping. In published statistics, all three of these items are lumped together under the heading of reconstruction.[8]

IV. Investment Allocations in the 1981–85 Plan

Industry receives the largest increase in investment during 1981–85—a 23-percent increase compared with 1976–80 (table 3). Historically, industry has received the lion's share of investment resources, but if the 1981–85 plan is fulfilled, industry's share would rise from about one-third (during the 1970s) to two-fifths of total capital investment. More than four-fifths of the increment to industrial investment is directed to just three branches—fuels and power, ferrous metals, and machine-building. The fuel and power industries alone have been allocated two-thirds of the total increase in investment in industry.

Capital investment in the entire fuel and power complex—electric power generation; coal, oil, and gas production; and pipeline construction—is slated to increase by 50 percent compared with 1976–80 (table 4). The investment goals for fuels and power include increases of 20 percent for electric power, 63 percent for oil, and 120 percent for gas. Although plans for the coal industry have not been published, investment in this sector probably will increase by about 20 percent.[9]

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[8] According to official data, the share of "renovation, expansion, and reequipping of existing enterprises" in the total volume of state capital investment increased from 68 percent in 1975 to 72 percent in 1980. Rumer estimates, however, that almost 60 percent of the money invested in existing enterprises between 1976 and 1980 was swallowed up by expansion. See Rumer op. cit., p. 21. According to Rumer, emphasizing reconstruction has increased the share of construction in total investment. "It seems justified to conclude that one of the consequences of expanding the extent of reconstruction in industry is to raise the share of construction in capital investment, and this leads to the relatively more rapid growth of buildings and structures than of equipment in fixed capital. In other words, the results attained contradict the stated goal." (Boris Rumer, "The Dynamics of the Capital Coefficient of USSR Industrial Output: Investment Process in Soviet Industry," Final Report to national Council for Soviet and East European Research, Washington, D.C., p. 26.)

[9] Gosplan Chairman Baybakov in a speech before the USSR Supreme Soviet in November 1981 stated that 132 billion rubles of capital investment would be allocated to the fuel and

Continued

TABLE 3.—USSR: INVESTMENT IN THE 11TH 5-YEAR PLAN

Sector	Billion rubles, 1973 prices		Percentage increase, plan 1981–85 over 1976–80
	1976–80 (actual)	1981–85 [1] (plan)	
Total	634.1	700	10
Industry	223.6	[2] 275	23
Ferrous metals	15.2	[2] 20	30
Fuels and power	65.7	[3] 100	52
Machinery [4]	53.9	[5] 59	10
Other	88.8	96	8
Agriculture	128.5	[2] 138	7
(Agriculture—whole complex of works)	(171.0)	(190)	(11)
Transportation and communications	75.9	(6)	(6)
Railroads	17.3	[2] 21	22
Construction	25.4	(6)	(6)
Housing	86.3	93	8

[1] In the case of total industry, ferrous metals, machinery, and the railroads, the 1981–85 figures were (a) calculated from planned percentage increases over 1976–80 published in the open press, and (b) rounded to the nearest billion rubles.

[2] Estimated.

[3] See table 4.

[4] Includes metalworking.

[5] Based on a statement by a Soviet official that capital investment in machine building will significantly exceed the level of the previous 5-year period.

[6] Not applicable.

Note: Data for 1976–80 are from Narodnoye khozyaystvo SSSR v 1980 g, p. 337. Plans for 1981–85 were compiled on the basis of information found in the open literature.

TABLE 4.—USSR: PLANNED ENERGY INVESTMENT DURING 1981–85

Energy sector	Billion Rubles, 1973 Prices [1]		Percentage increase, plan 1981–85 over 1976–80
	1976–80 [2]	Plan 1981–85 [3]	
Fuel and power complex	88	132	50
Nonpipeline investment	66	100	52
Electric power	19	23	20
Coal	10	12	20
Oil	26	43	63
Gas	10	22	120
Pipeline construction	22	32	45

[1] An explanation of the derivation of these data will be provided by the author upon request.

[2] Because of rounding, components of nonpipeline investment do not add to the total shown.

[3] In the case of electric power and oil, the 1981–85 figures shown were (a) calculated from planned percentage increases over 1976–80 published in the open press and (b) rounded to the nearest billion rubles.

Particulary ambitious targets have been set for the construction of gas pipelines. Five main lines extending from Tyumen Oblast in West Siberia to central regions of the country are to be brought on stream during 1981–85, and construction of a major export line from Urengoy to Western Europe is under way.

Investment in ferrous metallurgy is scheduled for a 30-percent boost during 1981–85 in an effort to revive steel production, to modernize producing facilities, and to improve product quality. In addition, Soviet sources have hinted that capital investment in the machine-building industry will "significantly exceed" the level of the

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energy complex during 1981–85. We estimate that the construction of gas and oil pipelines planned for this period will cost about 32 billion rubles. Subtracting this and planned allocations for oil, gas, and electric power published in the open literature (table 4) from 132 billion rubles results in an estimate of 12 billion rubles of capital investment for the coal industry during the 11th FYP.

previous five-year period.[10] Ferrous metals and machinery are pivotal industries in the USSR, and they must do better than they have in the past few years if the economy is to regain earlier rates of growth. More modern machinery is vitally needed in almost all sectors of the economy to improve labor productivity, to substitute for increasingly tight labor supplies, and to conserve energy resources—all key components of the official investment and growth strategy for the eighties.

Investment in the entire agricultural complex is slated to rise by 11 percent during 1981–85—compared with 31 percent during 1976–80—and maintain its 27-percent share of total investment. In particular, to reduce losses of farm products large increases are planned for constructing storage facilities—up 60 percent over 1976–80—and hard-surfaced roads on farms—up 40 percent over 1976–80. Crop waste and losses during and after harvest, reportedly amounting to 20 percent of total output annually, constitute one of Soviet agriculture's biggest problems.[11]

The increases in new fixed investment scheduled for the two major sectors of the economy—industry and agriculture—coupled with increases planned for the railroads and for housing construction more than consume the total targeted increment to overall investment. Consequently, investment allocations to selected industries and some sectors of the economy must have been cut. We cannot say with certainty which particular sectors have been singled out for reductions. Among the possibilities are the chemicals, construction materials, timber, and consumer goods (light and processed foods) branches of industry as well as the so-called nonproductive sectors of the economy—science, education, health, personal services, and the like. Investment allocations to most of these sectors, with the notable exception of the consumer goods industries, were reduced in 1980 compared with the previous year. Investment funds for most, if not all, of these sectors may have been slashed again in the plan for 1981–85. Even the consumer-related industries may have been cut despite leadership rhetoric that a central part of the program to raise living standards is the accelerated expansion of the light and food industries.

V. Consistency of Investment and Production Plans

A. TRENDS IN ICORS

Can the output goals for 1981–85 be achieved with the low growth planned for investment? For help in dealing with this question, we examined recent trends in the incremental capital-output ratios (ICORs) in industry—that is, the additional investment associated with a ruble's worth of additional industrial production. The ratios were then used to test the consistency between Soviet industrial output and investment plans for 1981–85.

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[10] A. Stepun, "O ratsional'nom napravlenii kapitalovlozheniy v odinnadtsatoy pyatiletke," Planovoye khozyaystvo, No. 10, (October 1981) pp. 34–42.

[11] The lack of adequate storage facilities is particularly serious. Last year in the RSFSR, for example, silage and haylage installations were available on only 44 percent of the republic's collective farms and 38 percent of its state farms. Only 55 percent of collective farms and 65 percent of state farms had vegetable and potato storehouses, and 83 and 76 percent, respectively, had grain and seed storehouses. See G. Kulik, "Ob effektivnosti kapital'nykh vlozheniy v sel'skom khozyaystvye," Planovoye khozyaystvo, No. 10 (October 1981), pp. 91–97.

Because of data limitations we restricted the analysis to industry. Alternative sets of investment requirements were calculated for industry in 1981–85 depending on whether (a) the ICORs continued to rise as they did in 1961–80 (Variant I in table 5), (b) the USSR managed to hold ICORs to 1980 levels (Variant II), or (c) the ICORs behaved as they did in 1976–80—that is, increased more steeply than in the 1961–80 period (Variant III).

TABLE 5.—USSR: ESTIMATED INVESTMENT REQUIREMENTS, 1981–85 [1]

[Billion rubles, 1973 prices]

	Variant I: 1961–80 ICOR trend continues	Variant II: ICOR stays the same as in 1980	Variant III: 1976–80 ICOR trend continues	Planned investment
Total industry	462	403	558	275
Ferrous metals	19	17	21	20
Fuel	58	46	80	77
Electric power	30	28	37	23
Machinery	112	97	115	59
Chemicals	47	41	61	[2] 22
Construction materials	42	33	73	[2] 9
Light industry	17	15	19	[2] 9

[1] The ICORs were derived by dividing changes in the capital stock by changes in output. The figures in the above table give investment requirements for each industry on the assumption that investment is equal to the expansion of the capital stock commensurate with various ICOR trends, with allowance made for replacement of wornout structures and machines as well as for projected increases in unfinished construction. An additional adjustment was made in the case of the fuels sector mainly because of large expenditures for drilling for oil and gas. Expenditures for drilling in the USSR are classified as new fixed investment, but such outlays do not result in additional commissioned capacity. To allow for this, the investment requirement figures for fuel in Variants I, II, and III were raised from their unadjusted values of 34, 27, and 47 billion rubles, respectively, as follows: During 1976–80 about 46 billion rubles were invested in the coal, oil, and gas industries, but the capital stock in these industries increased only 23 billion rubles. Allowing for an increase in unfinished construction of over 4.5 billion rubles and perhaps another 3 billion rubles of investment to replace wornout machinery and equipment means that each billion ruble increment to the capital stock required 1.7 billion rubles of capital investment during the period. Applying a similar ratio to the 1981–85 period yields the investment requirements shown in the table.

[2] The figures shown are the investment allocations during 1976–80. These industries probably face cuts. At best, investment will be held at 1976–80 levels.

The results for industry as a whole were sobering (figure 2). Whereas in the early 1970s each additional ruble's worth of output required three additional rubles of capital, by the end of the decade over six additional rubles of capital were required. Should this trend continue during 1981–85, overall industrial output would increase by little more than 2 percent per year rather than 5 percent per year as planned. Even if the rise in the incremental capital-output ratio for industry is somehow arrested, output would grow by no more than 3 percent annually during 1981–85.[12]

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[12] These calculations are based on Western estimates of actual industrial output, which differ from Soviet estimates because of methodological differences in their calculation. In short, Western observers consistently find official achieved rates of output growth to be biased upward. (On the other hand, ex ante planned indicators are acceptable). For more on these matters, see CIA Research Paper ER 80-10461, August 1980, "Comparing Planned and Actual Growth of Industrial Output in Centrally Planned Economies."

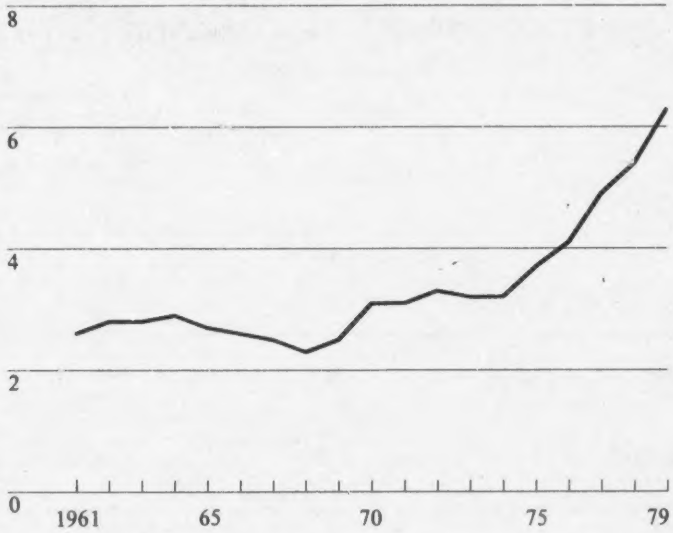
Moscow's perceptions of its economic problems, however, depend on its own economic statistics. To test the difference, we recalculated ICORs for total industry using Soviet figures for actual gross value of industrial output published in the annual issues of Narodnoye khozyaystvo. A comparison of the estimated investment requirements obtained with the results we obtained previously (table 6) are shown below in billions of rubles (1973 prices):

	Variants			Planned investment
	I	II	III	
Western output measure	462	403	558	275
Soviet output measure	383	355	477	275

There is substantial difference in the two calculations, indicating that Soviet perceptions of the USSR's investment needs may be much lower than our own. Still, even using the Soviet measure of industrial output, requirements exceed planned investment by a significant margin, particularly if recent ICOR trends continue.

Figure 2
USSR: Incremental Capital-Output Ratios in Industry, 1961-79

Three-Year Moving Average



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There appears to be two exceptions to the general picture of output goals being set far too high with respect to projected capital outlays. Investment plans for fuels and ferrous metallurgy appear sufficient to meet output goals even if ICORs rise in these sectors at the rates of the recent past. Even in some parts of these sectors, however, output goals may be beyond reach for other reasons. In the coal industry, for instance, labor shortages are hampering production.

As for other sectors, inadequate amounts of investment alone should preclude fulfillment of production targets. Investment goals for electric power, machine building, construction materials, light industry, and chemicals will be far short of requirements even if rising ICOR trends can be stopped—which, as we argue below, seems unlikely.

B. PROSPECTS FOR ICORS

It is highly unlikely that the planners can reverse or even arrest the rising trends in the incremental capital-output ratios in industry during the current five-year plan period. The ratios for overall industry and for individual branches such as chemicals, machine building, and construction materials would have to be reduced to mid-1970 or earlier levels in order to meet 1981–85 output targets. The factors that influenced ICOR trends in the late 1970s, moreover, are likely to have even more impact in the 1980s.

The Soviet economy is becoming increasingly dependent on the Siberian areas of the country for fuel and raw materials. Developing these new resource areas requires heavy capital investment, particularly construction activity. Construction costs in the eastern regions range from 30 percent higher to more than double those in the European part of the USSR. Furthermore, most of the areas where resources must be developed require large investments in both basic facilities for exploration and exploitation and social overhead capital—roads, housing, and cultural and service facilities. During the 1980s, for instance, the eastern regions of the USSR will provide almost the entire increment of oil and gas production and more than 90 percent of the increment of coal production.

In addition, in both the traditional producing areas of the European USSR and Siberia, the declining quality of readily available raw materials is pushing up capital requirements because of the cost of enriching the minerals and ores. As lower quality resources are being extracted from more distant, less hospitable locations, capital costs have been rising more rapidly than output.

The returns from many investment projects, moreover, will not materialize for long periods of time. This is particularly true in ferrous and nonferrous metallurgy, where the time to bring new capacity on line is often 10 to 15 years or longer. Large investment expenditures are required also to explore for new oil reserves. Return on this investment could be as far off as 5–10 years, the time it takes to bring new oil fields on stream.

For particular industries, these and other circumstances translate into escalating requirements for capital goods just to produce current levels of output. In the oil industry, for example, investment requirements are rising sharply, as reflected in the investment plans. Drilling activity is to almost double by 1985 compared with 1980, much of it to greater depths and in more isolated areas. This will require increasing amounts of high-quality drill pipe, rigs, and other equipment. In addition, the current inventory of producing wells is being converted from free-flowing to mechanized wells—particularly in West Siberia. This will require large investments in gas lift equipment, pumps, and the like. Meanwhile, the share of water in total fluid produced at Soviet oil fields has been increasing rapidly. Far more pumping equipment will be required in the 1980s to stabilize and maintain the oil output at aging fields.

Declining quality of resources has hindered steel and coal production. The erosion in iron ore grades, for example, has raised production costs sharply and forced the USSR to devote a growing share of investment to building iron ore beneficiating facilities. Accessibility to resource supplies has become a particularly difficult problem for the forestry and woodworking industry. Moscow has had to go further and further into climatically and geographically difficult areas of Siberia for new timber supplies.

Large up-front investment costs and delayed payoffs are being confronted particularly in transportation and in the nonferrous and ferrous metallurgy industries. For example, the Soviets are allocating large amounts of investment capital to the contruction of the Baikal-Amur Mainline (BAM). The return from this investment cannot be expected for many years since much of the increased investment expenditures is for structures such as roadbeds, bridges, and tunnels rather than equipment that might significantly improve present railroad performance through gains in worker productivity. In ferrous and nonferrous metallurgy, it often takes 10 to 15 years and in some cases even longer to bring new capacity on line.

VI. Coping With the Investment Squeeze

If trends in capital-output ratios continue to be unfavorable, the options available to the leadership in dealing with the investment squeeze are limited. It could try to (1) reduce dramatically the amount of unfinished construction in the different branches of industry, (2) lower retirement rates for the industrial capital stock, (3) increase imports of machinery and equipment, or (4) generally improve the planning and management of investment. None of these possibilities, however, hold much promise for significant gains in the near term.

A. REDUCED LEVEL OF UNFINISHED CONSTRUCTION

Reducing the large amount of unfinished construction—construction and installation work beyond initial stages but not finished to the point of permitting use of the assets—has always seemed to Soviet planners a cheap way of generating more fixed capital in a short time. The amount of unfinished construction has more than doubled since 1970 and in 1980 was equivalent to about 6 percent of the value of the total capital stock in the economy, and to almost 80 percent of total fixed capital investment. Indeed, the volume of unfinished construction is largest in some of the more troubled branches of industry—machine building and ferrous metals.

The existence of such a large volume of idle capital assets in the face of the increasing scarcity of investment goods is somewhat paradoxical. Much of the explanation lies in the persistent overbidding for investment resources by ministries and enterprises, for which capital is generally inexpensive. Much capital is allocated directly by the central authorities, and the relatively low 6-percent charge on capital that enterprises have had to pay since the mid-1960s has not significantly discouraged them from undertaking more investment than they can complete in reasonable lengths of time.[13]

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[13] Overbidding, as David A. Dyker points out, reflects the built-in incentive ministries have (a) to undertake as many building projects as possible in period 1 in order to get more investment

Continued

Even the rapid commissioning of this pool of idle assets would provide at best a one-time boost to the existing capital stock, not a continuous infusion of fixed capital. Furthermore, the boost would be relatively small. If Moscow succeeded in commissioning as much as half of the present volume of unfinished construction during 1981-85, the average annual growth of the total capital stock during this period would increase less than half a percentage point.

In point of fact, the Soviet leadership has rarely succeeded in reducing the backlog of unfinished construction. It has been rising almost without pause during the last two decades despite repeated efforts to reduce it. The single exception was 1980, when it fell by 1 percent.[14]

B. LOWER RETIREMENT RATES

Moscow could also make fixed capital grow faster by requiring enterprises to hold on to existing capital assets for longer periods of time. Retirement rates in the USSR, however, are already extremely low. Even though officially designated service lives of productive assets have been shortened twice during the postwar period—in 1963 and in 1975—Soviet asset lives still substantially exceed those in the United States and other Western economies. For example, the average retirement rate of the Soviet capital stock during 1961-80 was 1.5-1.7 percent annually.[15] By way of comparison, the overall stock of equipment and structures in the United States was retired at an average annual rate of 3.7 percent during the same period.[16]

Productive assets can be retained for longer periods only by heavier maintenance expenditures—"capital repairs" in Soviet terminology—and at the expense of modernization through investment in new equipment.[17] In 1976, 29 billion rubles were spent on capital repairs—13.3 billion for repair of buildings and structures and 15.7 billion to repair machinery and equipment. This was roughly equal to one-quarter of total capital investment that year.[18] When the large sums spent annually on current repairs, which are estimated to equal the cost of capital repairs, are added in, Moscow's maintenance bill becomes staggering.[19]

Reducing retirement rates, therefore, might well be counterproductive. The demands for capital and current repair would become

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funds in period 2 and (b) continue projects once begun even if they become uneconomical for fear of jeopardizing future investment allocations. Enterprises also have an interest in spending internally generated capital investment funds as rapidly as possible. See Dyker, op. cit., pp. 7-8.

[14] Note, however, that statistics on unfinished construction are given in current prices, whereas capital stock data are published in constant prices. There may be some overstatement, therefore, of the volume of assets available in the form of unfinished construction.

[15] CIA Reference Aid SOV 82-10093 (U), op. cit., pp. 10-11.

[16] See Cohn, op. cit., pp. 238-239, for a comparison of the service lives of industrial equipment in the USSR with those in the United States and other Western countries.

[17] In Soviet practice, maintenance expenditures fall into two categories: current and capital repairs. Current repairs cover preventive maintenance and routine servicing of machinery and equipment. Capital repairs involve major renovation outlays to replace defective or worn parts of existing assets in order to extend the useful life of machines. The former are treated as a cost of production whereas the latter are financed from amortization allowances. Capital repairs account for 40 percent and replacement investment for 60 percent of amortization allowances.

[18] Scot Butler, "The Growth of Capital Repair in the USSR, 1950-1977," unpublished, p. 53.

[19] Capital repair is also both a highly labor-intensive and capital-intensive activity that represents a heavy drain on scarce manpower and equipment resources. Repair activity, for example, absorbs an estimated one-tenth of the entire industrial labor force and one-third or more of the Soviet machine tool park.

even greater. Moreover, since capital repairs are an alternative to replacement investment, increasing service lives of existing assets would further delay the modernization of industry in the Soviet Union.

C. IMPORTS OF MACHINERY AND EQUIPMENT

The USSR could also ease the strain on investment resources by importing more machinery and equipment, both from the West and from Eastern Europe. Soviet purchases of machinery from the West, however, have fallen by two-thirds since the mid-1970s as the USSR struggles to right its hard currency balance, and Moscow's ability to increase machinery imports from the West is currently constrained by its tight hard currency position. The USSR's continuing requirements for hard currency imports of grain and other agricultural commodities, combined with soft Western markets for Soviet oil and other primary product exports, suggest that the leadership will be unable to buy substantial amounts of machinery and equipment from the West in the near term.

The East Europeans currently provide a large volume of machinery and equipment to the USSR. In the main, however, this machinery does not approach the quality or the technological level of that available in the West. Consequently, Moscow will not be able to turn to Eastern Europe for more sophisticated machinery. The Soviets also will be hard pressed to free up hard currency to purchase equipment in the West by turning to Eastern Europe for nonmachinery imports. Eastern Europe is not in a position to fill Moscow's needs for grain or much of its requirements for industrial raw and semifinished materials.

D. BETTER PLANNING AND MANAGEMENT

Improved planning and management of investment could offset some of the effects of slower investment growth. In particular, steps that would permit more rational allocation of investment among sectors and projects, and more rational use of investment resources on given projects, could help boost the overall productivity of capital. Without major (and unexpected) systemic changes, however, such improvements are unlikely. The basic problem is that resources for investment are still for the most part allocated more or less arbitrarily by Moscow.

Efforts to introduce economic criteria to put centralized, administratively determined investment on a more rational footing have not fared well. As noted above, squandering of capital resources was not materially reduced by terminating capital's status as a "free good" with the introduction in the mid-1960s of a 6-percent charge on capital. Nor has application of various "coefficients of effectiveness" to serve as measures of the return on capital helped. In any event, even well-designed and effectively enforced criteria could still lead to misallocation of capital because of the failure of Soviet prices to adequately reflect relative scarcities.

VII. Intensified Debate Over Investment Policy

The official view that the need for increased investment can be substantially avoided by higher capital productivity has been publicly challenged within the Soviet Union. The fact that opposition views were published at all suggests significant political support for such criticism and could mean that a debate over investment policy is currently under way in the USSR. The prominent Soviet economist A.G. Aganbegyan, for instance, questioned the planned distribution of investment in 1981-85 in Pravda earlier this year.[20] He argued that there should be more investment in the machinery sector now, even at the expense of other industries with a high priority for capital investment, since, in the long-run, the productive capacity of these other industries depends on the acquisition of more and better machinery.

The strongest and most direct criticism, however, appeared in two articles in the March 1982 issue of The Economics and Organization of Industrial Production (EKO).[21] The authors went beyond Aganbegyan's statement. They argued that increased capital productivity and the success of an "intensive" development strategy, at this juncture at least, require rapid growth in investment because:

—Rising labor productivity, through means other than increased productive capacity (such as better organization and management of labor), will lead to unemployment of workers released because of greater efficiency unless there is capital for them to work with.

—Capacity utilization rates went above optimum levels in the mid-1970s. Therefore, attempting to push these rates still higher simply leads to higher unit costs, increased downtime and reduced production.

—Capacity utilization rates in fact have recently fallen in many industries, but the lower rates do not indicate the existence of usable capacity that can be put into operation on demand. Rather, they reflect bottlenecks in sectors supplying inputs on which use of this capacity depends.

—Much of the USSR's plant and equipment is old and obsolete, requiring large investment outlays to replace these outmoded facilities with the modern, technologically advanced capital that economic progress and growth demands.

In other words, future progress in the development of the industrial sector is possible only on the basis of accelerating growth in the investment sector. More, not less, investment is required to make the transition from extensive to intensive growth.[22]

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[20] A.G. Aganbegyan, "Intensifikatsiya: sushchnosti, puti i sredstva klyuchevoy faktor rosta", Pravda, 24 February 1982, p. 2.

[21] K. K. Val'tukh, "Investitsionny kompleks i intensifikatsiya proizvodstva", and N. N. Baryshnikov and B. L. Lavrovskr, "Moshchnosti i reservy," Ekonomika i organizatsiya promyshlennogo proizvodstva, no. 3, 1982, pp. 4-51.

[22] According to Val'tukh: "Sometimes one has occasion to encounter the notion that raising the efficiency of capital investments unfailingly involves a transition to low rates of growth of the scale of investments. Quite the opposite relationship is the normal one: When capital investments grow rapidly, there is an opportunity to eliminate disproportions, to accomplish major structural shifts aimed at raising the technical level of production and product quality, that is, in the final analysis to increase the efficiency of the investments themselves and of the economy as a whole. A slackening of investment activity inevitably leads to disproportions and a drop in the benefit per unit of the capital investments."

Advocates of the existing policy of reduced investment growth have not fallen silent, however. In Ekonomicheskaya gazeta, D. Chernikov of the Gosplan Economics Institute maintained that studies undertaken by the institute have shown a trade-off between the rate of investment spending and investment leadtimes and capital stock retirement rates.[23] According to the study, too high a rate of capital investment requires longer periods of time for the investment to be assimilated and leads to slower rates of retirement of the capital stock. Modernization of existing plant and equipment is therefore delayed. He further notes that the studies have shown that capital and labor are not readily substitutable. Like Val'tukh, Chernikov implies that the complementarity between labor and capital is greater than generally believed. Chernikov concludes, however, that the rate of growth of capital investment should be slowed rather than accelerated to be consistent with the slower growth of the labor force and to take account of lags in the assimilation of new capital assets.

At some point, the arguments for higher investment may win out, particularly if economic growth continues to slow as we believe it will. This would entail, however, cutting either the defense sector or the share of resources going to the consumer, or both. Either of these options would be painful. Living standards are stagnating in the USSR. Reducing the rate of growth in defense spending would also be difficult given the momentum of present defense programs and the likelihood that the decision would have to be made during a succession period in the Soviet Union.

In any case, substantially raising the rate of increase in investment could not be done quickly. Much of the Soviet plant and equipment is badly in need of modernization, and resource bottlenecks are constraining production in industrial sectors that either produce investment goods directly—the machine-building industries—or provide inputs to these sectors—steel and construction materials. Boosting output in these industries will first require substantial investment in these sectors.

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[23] D. Chernikov, "Intensifikatsiya i sbalansirovannost'," Ekonomicheskaya gazeta, No. 10, 1982, p. 10.

II. PLAN AND PERFORMANCE

OVERVIEW

By Kate S. Tomlinson*

During the 1980s, the Soviet economy faces a number of major challenges: (1) the switch from an extensive to an intensive growth strategy, (2) declining rates of growth in the productivity of capital and labor, (3) the need to exploit sources of energy and other raw materials in the inhospitable, underdeveloped regions of Siberia and of transporting them to the center, and (4) increasing production in key industries such as iron and steel. Given the magnitude of these challenges, most Western observers expect the 1980s to be a decade of slow growth for the Soviet economy.

In the past, the Soviet Union was able to rely on a strategy of increasing inputs of capital and labor to achieve growth. But the extensive growth strategy has reached the limits of its usefulness and feasibility. During the 1980s, the labor force will grow more slowly than in the past and may even decline in absolute terms. Similarly, the rate of growth of investment is liable to decline. The Eleventh Five-Year Plan (1981–85) projects an average annual investment growth rate of 2.1 percent—the lowest in the postwar era. Thus, Soviet industry will have to shift to an intensive growth strategy of using inputs more efficiently.

But, trends in factor productivity have been mixed over the last two decades.[1] During the 1959–79 period, overall labor productivity grew regularly. In 1975, however, the growth of labor productivity began to trail off. By contrast, capital productivity consistently declined over the same period. Throughout most of the period (1959–77) the combined productivity of the two factors has generally been negative, whether calculated by sectors or industries. The major exception has been the transport and communications sector.

The persistent negative trend in Soviet capital productivity is a puzzling phenomenon. While labor productivity has tended to increase more rapidly than capital productivity in other industrial countries, as capital stock grows more rapidly than manhours of labor, capital productivity trends have not been persistently negative as they have been in the Soviet Union. In market economy, a declining capital productivity rate would mean that the rate of return on investment was falling. In the face of declining rates of return on investment, a decline in investment and, over time, a decline in the accumulation of capital stock would result, halting the fall in capital productivity. Thus, market economy countries would not duplicate the Soviet experience.

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* Kate Tomlinson is a contractor for the Office of Technology Assessment, U.S. Congress. However, this article was completed before her affiliation with OTA.

[1] Stanley H. Cohn, "Sources of Low Productivity in Soviet Capital Investment."

The chief causes of the dismal Soviet capital productivity rates are policies on retirement of plant and equipment and on replacement investment. Plant and equipment are retained in use about twice as long in the Soviet Union in major market economy countries. When fixed assets are not retired soon enough, production becomes less efficient; productivity declines; and the cost of maintenance and capital repairs increases. Both the planned and actual share of investment devoted to replace fixed assets (as opposed to new plant construction) in the Soviet Union is below the level in the United States. Recognizing the need to replace older assets with newer, more technologically advanced ones, Soviet economists believe that the amount of replacement investment is too low. It has been estimated that if replacement investment had been increased by 50 percent during the 1976–80 period and, if the retirement rate had been doubled, the Soviets could have held the productivity decline to one-half of its actual rate. Secondary factors behind the productivity trend include the following: (1) the low level of mechanization in direct and auxiliary production; (2) lags in the use of new technology in replacing old plant and equipment; and (3) unfinished construction projects which tie up an increasing share of investment without contributing to production.

During the 1980s the decline in Soviet capital productivity is expected to continue because of a trend to heavier investment in sectors with the highest capital-output ratios.

The downward trend in Soviet growth during the postwar period has been particularly steep after 1975. Average annual rates of growth fell from the 5.2 percent registered in the 1965–70 period to 3.7 percent in the 1970–75 period and to 2.7 percent in the 1976–80 period. Factor productivity likewise declined over the period. Several possible causes of the decline in the growth of factor productivity during the 1976–80 period have been identified.[2] One set of possible causes arises with the maturing of the Soviet economy. Examples are the aging of the capital stock and the depletion of long-exploited resources. As noted above, the productivity of older equipment is less than that of newer, more modern equipment and more repairs are required. Both of these factors have a negative impact on capital and labor productivity. With the depletion of the resource base in the European part of the Soviet Union, exploitation costs rise and factor productivity declines. The need to develop new sources of energy and other raw materials in Siberia entails high investment and transportation costs. This set of factors becomes more and more of a drag on productivity over time. The effect may be intensified by a second set of factors, strategic planning decisions. Thus, the decision to halve the rate of growth of investment during the Tenth Five-Year Plan (1976–80) may well have exacerbated the decline in factor productivity associated with the aging of the capital stock. It is likely, however, that the impact was not as great as the magnitude of the cut in the rate of growth of investment would suggest. Paradoxically, the decision to increase imports of Western technology may have slowed productivity growth in some sectors because the introduction of foreign technology requires inputs of high quality domestic resources, which could lower productivity in the sectors from which were diverted.

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[2] Herbert S. Levine, "On the Possible Causes of the Deterioration of Soviet Productivity Growth, In the Period 1976–1980."

A fourth set of factors includes fundamental aspects of the Soviet economic system such as barriers to innovation, ministerial resistance to coordination between branches of the economy, and centralized planning, which intensify as the economy matures. In a maturing economy, the capital-labor ratio rises and technological changer becomes an increasingly important source of productivity growth. As an economy grows in size and complexity, interbranch coordination become more important, and the impact of errors in planning and coordination increases.

A fifth set of factors either emanate from outside the Soviet Union or are largely beyond the control of the leadership such as the weather and the slowing movement of workers from the low productivity agricultural sector to higher productivity sectors in urban areas. Bad weather in 1977, 1979, and 1980 was a major cause of reduced agricultural output, reducing productivity growth in agriculture and in industries using agricultural products as inputs. A sixth set of factors may have served to intensify the impact of the others on productivity growth. Possible examples are the disappearance of slack in the economy and unfulfilled expectations about living standards, which may have contributed to the decline in labor discipline noted during the period.

In recent years, performance in several key industries has been disappointing to the Soviets. In addition to shortfalls in the production of grain, coal, and consumer goods, which are discussed in other sections of this volume, the steel industry began to falter in the late 1970s. Soviet steel production grew steadily during the 1950–1975 period, surpassing that of the United States in 1971. By 1981, the Soviet Union produced about one-fifth of total world output—more than produced in the United States or Japan. Notwithstanding these achievements, the Soviet steel industry failed to achieve its goals for 1980. The production increase during the 1976–80 period was in fact not much larger than the average annual increase during the 1960–75 period. By the end of the 1970s, the Soviets had lost their status as a net exporter of steel and had turned to the West for supplies of rolled steel and steel-producing technology.

The causes are varied; investment in the industry was imbalanced, favoring crude steel production over modernization or improvements in quality. In comparision with steel-makers in the United States and Japan, Soviet steel plants have low yields, i.e. amount of finished rolled steel compared to inputs. Problems with supplies of inputs of iron ore, coking coal and scrap metal were a major constraint on steel production in the 1970s and are likely to continue to be in the 1980s. Behind the shortages of inputs are bottlenecks in transporting materials often over long distances to steel mills and, in the case of iron ore and coking coal, an inability to bring new capacity on-stream fast enough to affect stagnating or falling production in older basins.[3]

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[3] Central Intelligence Agency, "Sluggish Soviet Steel Industry Holds Down Economic Growth."

The outlook for Soviet steel production during the first half of the decade is not favorable. The goals of the Eleventh Five-Year Plan, which are similar to those originally set, but latter reduced, for 1980 are unlikely to be met. In addition, the modernization of the steel industry is likely to be held back. Modern, efficient steel mills under construction at Novolipetsk and Kursk with the assistance of Western firms may offer some relief in the latter part of the decade. In the meantime, imports of high-quality products such as pipe, cold-rolled steel, and tin plate may be increased depending on the priority of the iron and steel sector and the availability of hard currency.

In all economies, the performance of the transportation sector is critical to overall economic performance. This relationship, however, applies with particular force in the Soviet case due to the immensity of the Soviet Union and the dispersal of resources. The Soviet transportation system, one of the largest in the world, has met the economy's needs fairly successfully until recently.[4] But, as the problems in the supply of raw materials to the iron and steel industry attest, there have been strains in the system for particular commodities and routes and during bad weather conditions as in the winter of 1979. Moreover, there are gaps in the transportation system and inefficiencies in the use of transportation services.

As a result of conscious policy decisions over the past 60 years, the Soviet Union lacks a well-developed system of all-weather roads, linking cities and farms to markets. In recent years, however, the volume of inter-city trucking has become significant. Climate and geography limit coastal and inland shipping. While transportation via pipeline has grown, the greatest burden has traditionally fallen on the railroads.

Inefficiencies in the transportation system that have been noted in the Soviet press include "irrational shipping," or transporting goods across country instead of to nearby plants, shipping goods short distances by railroad instead of by truck, which would be more economical, "underloading," and the related failure to process goods properly before shipment. In addition, there is an apparent shortage of railroad cars, which may not be an actual shortage, but the result of less efficient use of existing cars. Two causes of these and other inefficiencies are the use of tons per kilometer as the success indicator for transport organizations and the low cost of transportation services, which leads enterprises to use them wastefully.

As in other sectors, capital productivity has been declining in the transportation sector.[5] One of the main causes of the decline in the factor productivity of the key component, railroads, is the aging of the capital stock (e.g. freight cars and bridges). This development was worsened by decisions during the 1960s and the 1970s to reduce the share of investment allocated to railroads. These factors contributed to a decline in the rate of growth of rail freight since 1975, which in turn contributed to the slowdown in productivity growth in the other sectors of the economy.

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[4] Holland Hunter and Deborah A. Kaple, "Transport in Trouble."

[5] Levine, *op. cit.*

During the 1980s, the transportation system will be hard pressed to serve the needs of the Soviet economy. In particular, rail transport seems to be nearing its physical limit, given existing technology and facilities. Signs of gridlock are appearing. Needed increases in investment for railroad facilities are unlikely, despite the priority of the Baikal-Amur Mainline.

Signs of mounting shortages of consumer goods, especially foodstuffs, during the late 1970s and early 1980s received great attention in the West.[6] There were reports that supplies were disappearing from stores even in major cities, that prices were escalating on private (kolkhoz) markets, and that formal rationing had been introduced in some areas. These developments were generally read in the West as evidence of inadequate supplies or, in the case of some commodities, of an absolute decline in supplies. On its face, the case for physical shortages seems compelling. Beginning in 1979, there were four poor grain harvests in a row. Many other crops also fared poorly during the period. Official Soviet statistics show a decline in the production of some major food stuffs, particularly meat and milk, since 1979. While there is evidence that supply side factors were at work, increasing demand fueled by increases in purchasing power may also have played a role. Although Soviet statistics show declines in per capita consumption of some foods during this period, they do not show declines in per capita consumption of most foods and non-food items that would help confirm physical shortages. There is evidence that there was a substantial increase in the amount of currency in circulation, resulting from an increase in the amount of credit made available. Moreover, disposable incomes increased by 20 percent since 1977, according to official Soviet statistics. Thus, the increases in disposable incomes outpaced increases in consumer goods supplies. In addition, the savings bank deposits of Soviet citizens grew by 60 percent between the end of 1976 and the end of 1981—more than the increase in disposable incomes.

The development of territorial industrial complexes (TPKs) holds promise for meeting some of the challenges facing the Soviet economy during the 1980s. TPKs, which have been begun to develop important natural resources in Siberia and elsewhere, are "planned set[s] of interrelated industries and associated economic and social infrastructure located within a relatively compact area and focused on the exploitation of one or more natural resources." [7] It is not enough for the industries in a TPK to be located in the same area; they must be planned to form a coherent whole with forward and backward linkages among them. TPKs could be useful for the following reasons: (1) By focusing resources on a limited number of high priority projects, the TPK strategy would reduce the proliferation of projects and reduce squabbles over resource allocation by regional and ministerial interests. (2) By realizing agglomeration economies through forward and backward linkages, they could economize on capital and labor. Such savings would be especially beneficial in a time of declining growth of investment and labor force. These prospects make the TPK concept attractive to Soviet leaders and planners. Although TPKs fit into the Soviet tradition of regional planning and plans for resource development, finding an appropriate managerial structure for them is difficult. Conflict and lack of cooperation among ministries make interbranch coordination difficult. This complicates development of the TPKs, which include industries subordinate to different ministries.

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[6] Gregory Grossman, "A Note on Soviet Inflation."

[7] David S. Kamerling, "The Role of Territorial Production Complexes in Soviet Investment Strategy."

Soviet interest in the TPKs as a major feature of resource development built up during the 1970s and culminated in the official designation of three TPKs in the Ninth Five-Year Plan (1971–75). During the Tenth Five-Year Plan, their number was tripled, but during the Eleventh Five-Year Plan the number was reduced. The decrease was probably related to the decision to reduce the rate of growth of investment, not to a faltering of official interest. Decrees in 1979 and 1980 by the Central Committee and the Council of Ministers gave Gosplan the authority to plan and oversee the TPKs regardless of which ministries were responsible for individual industries within them.

A TPK-centered development strategy has potential, but bureaucratic resistance to change and ministerial conflict may reduce the potential. Due to these problems and the reduction in the rate of growth of investment, the TPKs now planned or under construction are not likely to be fully developed during the Eleventh Five-Year Plan.

POSSIBLE CAUSES OF THE DETERIORATION OF SOVIET PRODUCTIVITY GROWTH IN THE PERIOD 1976-80

By Herbert S. Levine*

CONTENTS

	Page
I. Outline	153
II. The Causal Categories	155
1. Exogenous Factors	155
A. Weather	156
B. Economic Conditions Abroad	156
C. Demographic Trends and Shifts	157
2. Consequences of a Maturing Economy	157
A. Depletion of Resource Base	157
B. Aging of the Capital Stock	158
3. Strategic Planning Decisions	160
A. Defense Expenditures	160
B. Investment	161
C. Technology Transfer	162
4. Systemic Elements	163
A. Systemic Effects in a Maturing Economy	164
B. Plan and Labor Discipline	164
C. The Second Economy	165
III. Conclusion	166
1. Tautness and Interindustry Balance	166
2. Disillusionment With the System	167

I. OUTLINE

This paper is the introduction to a study being undertaken (at the Centrally Planned Economies Projects of Wharton Econometricts Forecasting Associates, Inc.) of the sharp deterioration in productivity growth in the Soviet economy in the second half of the 1970s. In this introduction the possible causes of the deterioration in Soviet economic performance are briefly catalogued and discussed. The full study itself will contain analyses of the statistical data on Soviet growth and several in-depth case studies which are representative of the different categories of the possible causes of growth retardation suggested here. A major objective of the full study is to evaluate the extent of reversibility of the causal factors examined: which of them are transitory; which appear potentially responsive to present, proposed, or possible Soviet remedial policies; and which are deeply ingrained, persistent, not easily and not likely to be reversed. This improved understanding of developments in the Soviet economy in the second half of the 1970s is important for our work on the Wharton Econometric Model of the Soviet Union (SOVMOD). It will contribute to decisions on how to handle the strikingly poor performance exhibited in this period in estimating the model, and thus, in developing projections for the Soviet economy in the eighties and nineties.

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Soviet economic growth has been trending downward since the end of World War II. The reasons given for this general trend usually include such factors as decreasing returns to capital, low elasticity of substitution of capital for labor, and a low rate of introduction and diffusion of new technology. As the data in Table 1 indicate, this downward trend is rather sharply intensified in the period after 1975. In regard to overall GNP, it might be argued that this was a period of unusually bad weather, in that three of the five years (1977, 1979, and 1980) had below normal temperature and precipitation which led to three bad harvests, and in an economy in which agriculture accounts for about 15 percent of GNP this in itself had a significant effect on the growth of output and factor productivity. While there is merit in this argument, it is interesting to note that the sharp downward break in the downward trend is more evident in industry than it is in overall national product. This is particularly true with regard to productivity growth which is the focus of our study.

TABLE 1.—GROWTH OF OUTPUT AND PRODUCTIVITY

[Average annual rates of growth, in percent]

	1960–65	1965–70	1970–75	1975–80
Gross national product [1]	5.0	5.2	3.7	2.7
Labor productivity [2]	3.4	3.2	2.0	1.3
Total factor productivity [3]	0.6	1.1	−0.5	−0.8
Industrial production	6.6	6.3	5.9	3.6
Industry labor productivity [2]	3.6	3.1	4.4	2.0
Industry total factor productivity [4]	−0.1	0.5	1.1	−0.6

	1976	1977	1978	1979	1980
Gross national product [1]	4.8	3.2	3.4	0.8	1.4
Labor productivity [2]	3.6	1.7	1.7	−0.7	0.2
Total factor productivity [3]	1.2	−0.4	−0.3	−2.7	−1.9
Industrial production	3.9	4.0	3.5	3.0	3.4
Industry labor productivity [2]	1.6	2.4	1.8	1.6	2.4
Industry total factor productivity [4]	−1.0	−0.4	−0.7	−1.1	−0.2

[1] Based on indexes of GNP (in 1970 rubles), by sector of origin, at factor cost.

[2] Output per man-hour.

[3] Output per combined input of man-hours, capital, and land.

[4] Output per combined inputs of man-hours and capital.

Source: National Foreign Assessment Center,"Handbook of Economic Statistics," 1981, NF HES 81–001, Washington, D.C.: CIA, November 1981, p. 60.

The aim of the study is to identify and analyze the possible causes of this sharp deterioration in productivity growth in the late 1970s. Since the task is to contribute to the understanding of the recent experience rather than the general downward trend, we want to identify the special elements in the Soviet economic picture in the 1976–1980 period rather than the causes of Soviet productivity problems that have always been there. That is, we want to identify what are the new factors at work in the economy in the second half of the 1970s, or what are the factors that have built up over time to a new level of influence that account for the drop in productivity growth in this period.

We will group the possible causes of productivity problems that we have identified into the following four categories:

1. Exogenous factors
2. Consequences of a maturing economy
3. Strategic planning decisions
4. Systemic elements

These categories will be discussed at length in the next section of the paper. But, before going on to that discussion, a few comments about this attempted taxonomy. Some difficulties arise because a number of causal factors belong to more than one category. For example, the aging of the capital stock is an element of the "maturing economy" category, but it is also an element of the "strategic planning decisions" category, in that it is related to Soviet policies of maintaining capital active over long periods through extensive capital repair, and policies opposed to rapid retirement of capital subject to technological obsolescence. Secondly, the categories are not independent. They interact, often intensifying each other. Poor weather is a cause of bad harvests, but its effect is intensified by systemic elements in the Soviet economy which contribute to the lack of flexibility and responsiveness to changes in the environment that can be observed in the behavior of Soviet agriculture.

In the full study we will include three case studies. The first is a study of the transportation sector, which is intended as an illustration of the problems of a maturing economy, in particular with regard to the aging of the capital stock. The second is a study of technology transfer, the importation of technologically advanced machinery from the West, in the metallurgical sector. This is intended to illustrate an important strategic planning decision taken by Soviet leaders in the period under review. The third is a study of the construction sector, intended to serve as an illustration of certain systemic elements of Soviet organization, planning, and management, and emphasizing the construction sector's specific role in the period and attempts to reform it.

II. The Causal Categories

1. EXOGENOUS FACTORS

The first category of possible causes of the downturn in Soviet productivity growth in the late seventies is that of exogenous factors. In this category we include those factors that emanate from outside of the Soviet Union, or in other ways are outside of the control of Soviet leaders and outside of the direct influence of the behavior and development of the Soviet system. Such factors include: the weather, economic conditions abroad, demographic trends and shifts. These factors, which contributed to the productivity growth deterioration in the period 1976–1980, possess the characteristic of perhaps being transient in their nature depending on their own patterns and causes, but divorced from the policies and system reforms that Soviet leaders might undertake.

A. Weather

We have already mentioned the fact that in three of the five years under discussion, weather conditions were below normal, which is a higher incidence of bad weather than is observable in the other five-year intervals in the period, 1960–1975. Bad weather leads to lower output of agricultural crops and in turn to lower factor productivity in agriculture. Reduced agricultural output also contributes to lower productivity in those industries that use agricultural products as raw material inputs especially textiles and food processing. Since material inputs are reduced without reducing labor and capital inputs, the fall in output growth in these industries is translated directly into a fall in factor productivity growth. Furthermore, reduced agricultural output makes it necessary for workers throughout the economy to spend more time in the search process, locating and lining up for the food that is available. Some of the time spent in this search process may well come out of the time for which the worker is officially recorded as being at work, thus, contributing to the slowdown in productivity growth in the non-agricultural sectors. Finally, low agricultural output also contributes to the lowering of labor productivity through the lowering of worker morale and the incentive to work, which some claim are features of the 1970s, and which we will discuss later in the paper.

In addition to its effects on agriculure and through agriculture on productivity in industry and elsewhere in the economy, bad weather can have a direct effect on non-agricultural output and productivity. In the first 2–3 months of 1979, the weather in the Soviet Union was so extremely cold that it caused significant reductions in transportation activity. This, in turn, caused great hardships to industrial activity through disruptions of material supply, thus, contributing to the reduction in productivity growth.

B. Economic conditions abroad

Soviet economic performance and productivity growth are affected by economic conditions abroad through the mechanisms of international trade, in particular, through the Soviet import of advanced machinery and technology from the West. During the second half of the 1970s, Western economies were in a period of recession and weak growth. This had the effect of limiting Western imports from the Soviet Union, thus, reducing its hard-currency earnings and the amount of Western technology the Soviet Union was able to import. On the other hand, the second half of the seventies was a period in which world prices of oil and gold rose very substantially, providing the Soviet Union (an oil and gold exporter) with a major windfall in its hard-currency earnings.[1] This tended to counteract the negative effects of Western recession.

The dramatic rise in world oil prices subsequent to the Arab oil embargo of 1973 has been said by many analysts to be an important element in the productivity growth slowdown observed in all industrialized nations since the early seventies. Presumably, the mechanism that accounts for this is the substitution, in market economies, of relatively less expensive inputs for relatively more expensive inputs, which in a situation of rising oil prices, meant that labor tended to be substituted for oil through an increase in the labor-capital ratio (reduction of oil-consuming machinery), leading to a decrease in labor productivity growth. Did anything resembling this take place in the Soviet Union? The issue is not that the Soviet Union is an oil-exporter, but, the weak role of prices, especially world prices, in Soviet resources allocation decisions. What has to be explored is Soviet oil conservation mechanisms and the extent to which they were applied, in particular in the years after 1977, when Soviet leaders appeared to recognize the reality of the decreasing growth of Soviet oil production.

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[1] See Edward Hewett, "The Foreign Sector in the Soviet Economy," in A. Bergson and H. S. Levine (eds.), "The Soviet Economy Toward the Year 2000," London: George Allen and Unwin, forthcoming.

C. Demographic trends and shifts

The sharp drop in the rate of growth of the working age population, that has been receiving so much attention in analyses of Soviet economic growth prospects, does not really begin until 1980. Therefore, it is not a causal element in the deterioration of Soviet economic performance in the period under review here, 1976–1980. There is, however, a demographic shift, in our period, that is of some relevance, and that is a slowing down in the pace of population movement from the rural to the urban sector. The level of urbanizatin (the share of urban population in total population) grew at an annual rate of 1.33 percent in the 1960s, 1.29 percent in the first half of the 1970s, and fell to 0.86 percent in the second half of the 1970s.[2] This decrease in the pace of population movement from lower productivity agriculture to higher productivity industry and other nonagricultural sectors contributed to a lower overall growth of productivity in the Soviet economy.

2. CONSEQUENCES OF A MATURING ECONOMY

The second category of possible causes for the slowdown of Soviet productivity growth includes those factors associated with the maturing of the Soviet economy. While they exist and affect Soviet economic performance before the mid-seventies, their effect grows with the lengthening of the time period of Soviet industrialization and, thus, they play a role in the slowdown of productivity growth after the mid-sevenites.

A. Depletion of resource base

During the course of the 1970s, the raw material base in the established industrialized West European areas of the Soviet Union, were becoming depleted. This was particularly true in the case of oil, coal, and iron ore. With the depletion of the resource base in the major industrial regions, costs of producing raw materials in these regions have risen, that is factor productivity has deteriorated. And, new sources of these raw materials have been developed in the Eastern regions. In the production of oil, since 1970, the output from the Western region and the Urals has stagnated, and all the increase in output has come from West Siberia.[3] With regard to coal, in the period since 1975, the output from the old coal producing regions of Western Russia (including the Donets basin) and the Urals has declined, while that from Kazakhstan, Central Asia, Siberia and the Soviet Far East has increased.[4] This shift in resource base has entailed high investment costs and high transportation costs, since the bulk of the raw materials produced in the Eastern regions is shipped back to the Western industrialized region for processing.

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[2] "Narodnoe Khozyaystvo v 1980" p. 7. Rates of growth are calculated from the data given for January 1961, 1971, 1976, and 1981.

The effect on productivity growth of this depletion of resources in the West and the shift of the resource base to the East, would appear to be quite negative. Clearly, the effect is negative with regard to the continuing production of oil and coal in the West. But, there are some who argue that with regard to the shift of energy production to the East, that costs of production there are relatively quite low and even when transporation costs are added in, there is still a net saving compared with energy production in the Western regions.[5] To what extent, if any, these savings are able to offset the decreased productivity in the West is, however, not clear.

B. Aging of the capital stock

The aging of the Soviet capital stock is another important element within the category of the maturing of the Soviet economy. However, its role as a cause of the sharp deterioration in productivity growth after 1975 may not be quite as clear as was argued in the case of the depletion of resources. For it is a factor that builds up over time, increasing its strength as the size and age of the capital stock grows, rather than a factor that first appears in our period, or takes on discernably new dimensions in it.

While being an element of the maturing of the economy, the aging of the capital stock is also directly related to a strategic planning decision that the Soviets have consistently pursued—the policy of retaining capital stock for long periods of time. The Soviet rate of retirement is very low. Soviet data and calculations based on them indicate that for the economy as a whole, in the sixties and seventies, the rate of retirement (capital retired during a year as a percent of the capital stock at the beginning of the year) averaged about 1.5 percent, while for industry it was a little higher, but still below 2 percent.[6] For the United States, the comparable figures are more than twice that level, 3.7 and 4.2 percent.[7]

In order to keep so much capital in the active capital stock and in operating condition, a very substantial amount of capital repair has to be performed. This requirement is intensified by the age of the capital stock. That is, the older the capital, the more the capital repair that is required.

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[3] Edward Hewett, "Energy Economics and Foreign Policy in the USSR," Washington, D.C.: Brookings (forthcoming), ch. 2.

[4] CIA, "USSR: Coal Industry Problems and Prospects," March 1980.

[5] See, e.g., Ia. Mazover and T. Makarova, "Effektionost' toplivnykh baz Sibiri," Planovoe khozyaystvo, 1981:4, pp. 61–65.

[6] CIA, "Soviet Statistics on Capital Formation," August 1982, p. 10.

[7] Ibid.

The aging of the capital stock has, then, two detrimental effects on the growth of factor productivity. First, when labor is combined with old capital (even if it is well maintained), labor productivity is lower than it would be if combined with newer, more modern, technologically advanced capital. And second, the activity of capital repair itself requires the use of capital equipment. One Soviet source recently stated that at times as much as 40 percent of the machine tool park is used for capital repair rather than new capital formation.[8] This has a strong negative effect on the growth of capital and labor productivity.

The problem is aggravated by the chronic Soviet practice of underfulfilling plans for the completion of construction projects, which lengthen the gestation period before the commissioning of new capital. This leads to the retention of more old capital than was planned, and in turn to lower then planned growth of labor productivity. Furthermore, since old capital requires more capital repair than newer capital, repair facilities are strained, which contributes to the high proportion of machine downtime (idle machinery, waiting for repair) that is observed in the Soviet economy. The high rate of idle machinery is also affected by the Soviet practice of underproducing spare parts, the resulting shortage of which limits the ability to perform effective capital repair.

Transportation is a sector of the economy where there have been frequent complaints about the aging of the capital stock in recent years.[9] The most evident manifestation of this is the great number of old freight cars in poor condition that are still in service. Also, railroad track and other rail transport structures such as bridges (of which there are over fifty thousand) are often in need of repair. The presence of so much old capital has been a major factor in the low factor productivity growth in the 1970s in the Soviet railroad sector.

This problem has been intensified by the strategic planning decision taken by Soviet leaders in the sixties and seventies to reduce the share of investment going to railroads. As a result, the capital stock in railroads grew at about half the rate of growth of the total capital stock in the economy as a whole in the period 1965–1980. Furthermore, not only were the additions to capital stock rather modest, they were also not of sufficiently advanced technology to impede the negative effects of the aging of the capital stock. This capital aging and slow growth of capital stock contributed to the sharp decrease in the rate of growth of railroad freight traffic in the period after 1975. Railroad freight traffic grew at an annual rate of 5.1 percent in the period 1965–70; 5.3 percent in 1970–75; and plunged to 1.2 percent in the period 1975–80. While this dramatic slowdown in the growth of rail traffic could have been caused by the slowdown in the growth of output, it is more likely that it itself is an important factor in the slowdown of productivity growth in the rest of the economy. For it contributed to the bottlenecks and imbalance of materials discussed below in the concluding section of the paper.

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[8] Article by Academician V. Trapeznikov in Pravda, May 7, 1981, pp 2–3. (See also the *Current Digest of the Soviet Press*, XXXIV: 18, (June 2, 1982), pp. 1–4.

[9] This section is based on Holland Hunter and Deborah A. Kaple, "Transport in Trouble," in US Congress, Joint Economic Committee, "*Soviet Economy in the 1980s—Problems and Prospects,*" Washington D.C.: GPO, forthcoming.

3. STRATEGIC PLANNING DECISIONS

The category of strategic planning decisions encompasses a number of the economic policy decisions taken by Soviet leaders and planners which may have had an effect on the growth of productivity in the second half of the seventies. The key aspect of this category is that these decisions were taken on the basis of an evaluation of their expected effects and, therefore, can be altered by Soviet leaders if they perceive that their original evaluations turned out in practice to be incorrect or undesirable. Clearly, since strategic planning decisions are made within an interrelated matrix of policies which also involve the interests of different groups in the society and, more particularly, within the decision-making elite, these economic policies are not altered easily. The point, however, is that in their nature the strategic planning decisions are more amenable to the control of Soviet leaders than are the elements of the other causal categories.

A. Defense expenditures

A major group of strategic planning decisions involve the distribution of national product among its various uses. Let us begin with expenditures on defense. The Soviets devote a high proportion of final demand to defense. These expenditures, according to published CIA estimates, have grown at a fairly steady 4-5 percent per year through the sixties and seventies. Since the growth of GNP falls below 4 percent per year in the early seventies, and below 3 percent per year in the late seventies, the share of defense in total GNP rises from a level of 12-13 percent of GNP to a level of 13-14 percent by the end of the seventies.[10] This tends to indicate that the drag of defense on economic growth may have increased somewhat through the period under review.

The most direct way that the commitment of resources to defense affects growth is through the defense—investment tradeoff. The procurement of machinery items for the defense sector comprises, in the 1970s, roughly one-third of the total output of machinery, and this share appears to increase slightly toward the end of the period.[11] This is not an insignificant diversion of machinery from the growth of the capital stock to the use of the military. But, it is not only the gross aspect of this relationship that is important. On the face of it, the substitution of defense for investment would appear to affect the growth of economic output, but not of factor productivity. In a number of ways, however, the commitment of resources to defense is also a burden on the growth of factor productivity. First of all, the slower growth in the capital stock, especially in the machinery component of the capital stock impedes the modernization of the stock of capital and thus contributes to low growth of capital and labor productivity. Second, high quality human and material resources tend to be diverted into the development and production of military equipment, depriving the civilian sector of these high productivity resources. And third, capital stock in the civilian sector is often designed with the possible conversion to military production in mind, which lowers its productivity in civilian production. Also, productive capacity in the defense sector appears to be built with contingency needs in mind, and in normal times part of that capacity is used for civilian needs, in particular, the production of consumer durables. Such production is much less efficient than it would be if the capital had been designed for civilian needs.

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[10] U.S. Congress, Joint Economic Committee, "Allocation of Resources in the Soviet Union and China—1981," Part 7, Washington, D.C.: GPO, 1981, pp. 251-52.

[11] SOVMOD Databank.

To the extent that the use of resources for military need grows in a relative sense in the latter part of the seventies, it becomes a contributing cause of the deterioration in productivity growth in our period.

B. Investment

A second important set of policy decisions in the 1970s concerns the growth of gross fixed investment. Soviet planners made the decision to drastically cut the growth of investment in the period of the Tenth Five-Year Plan, 1976–1980, and to devote an increasing share of investment to machinery and equipment rather than new construction. The aim of this policy was primarily two-fold: one, to focus investment on existing projects and so decrease the growth of unfinished construction and, thereby, the gestation period in the commissioning of new capital; and two, to concentrate on modernizing and renovating the existing capital stock.

The rate of growth of fixed investment falls drastically, from an annual rate of 7.0 percent in 1970–1975 to an annual rate of 3.4 percent in 1975–80 (see Table 2). However, the rate of growth of the machinery component of investment falls much less drastically, from an annual rate of 7.6 percent to a rate of 5.5. percent. Capital stock growth changes less quickly than the change in the growth of investment, due to lags and the mathematics of the relationship between the growth of investment (annual additions to the capital stock) and the growth of the capital stock itself. But in addition, in our period, it falls less quickly due to the decrease that the Soviets were able to achieve, by the end of the period, in the growth of unfinished construction. The total capital stock in the economy grows at an annual rate of 7.9 percent in the first half of the 1970s and falls to a rate of 6.8 percent in the second half, while the growth of the stock of unfinished construction falls from an annual rate of 7.6 percent to 6.8 percent (as a result of an absolute decrease in the stock of unfinished construction in 1980).

These data indicate that the dramatic halving of the rate of growth of investment in the latter part of the 1970s may ovestate the negative effect on output and productivity growth of the policy decision to cut the growth of investment. The drop in the growth of capital stock is less drastic, and it is after all the growth in capital stock rather than investment that affects output and productivity growth. Furthermore, the decrease in the growth of investment is not equally borne by machinery and structures. The drop in the growth of the machinery component of investment is much less than that of overall investment, and presumably the same holds for the relationship between the growth of the stock of machines and the growth of the total capital stock.[12] Therefore, while there is probably a negative effect on the growth of factor productivity from the decision to reduce the growth of investment (slowing down in the pace of modernization of the capital stock) this negative effect is likely much less than that which would be indicated by the sharp drop in the rate of growth of overall investment in the economy. This issue of investment policy is controversial and of great importance to our analysis. We will return to it, below.

TABLE 2.—CAPITAL FORMATION, 1970–80

[Average annual rates of growth, in percent]

	1965–70	1970–75	1975–80
Gross fixed investment	7.6	7.0	3.4
Machinery component of investment	7.6	7.6	5.5
Stock of fixed capital	7.4	7.9	6.8
Stock of unfinished construction [1]	8.8	7.6	6.8

[1] In "Implied comparable prices." See Movit (below), table 11.

Sources: 1. Charles Movit, "Performance of the Construction Sector in the USSR 1965–80," Working Paper, Wharton Econometrics Forecasting Associates, Centrally Planned Economies Projects, October, 1982. 2. CIA, "Soviet Statistics on Capital Formation," August 1982.

C. Technology transfer

A third noteworthy economic policy decision taken by Soviet leaders, was the decision to increase imports of advanced technology and equipment from the industrially developed countries starting at the end of the 1960s. In some previous work, Donald Green and I have argued that industrial machinery imported by the Soviet Union, in the period 1968–1973, was of significantly higher productivity than domestic machinery and brought with it substantial benefits for Soviet industry.[13] The methodology used in our study and our end results were disputed by many.[14] The generally held view, however, is that while the Soviets may not derive as much benefit from technology transfer as our earlier work indicated, they do derive benefits from it.[15] In the attempt, here, to identify and analyze the factors contributing to the sharp drop in productivity growth in the second half of the seventies, a question about the role and impact of technology transfer arises. Was it that the benefits of technology imports were just not substantial enough to counteract the other retarding factors? Or is it possible that in some individual sectors, in our period, technology imports may have actually contributed to the slowdown of productivity growth?[16]

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[12] This appears to be true for industry, see Elizabeth A. Goldstein, "The Effect of Technology Transfer on Production and Productivity Growth: A Case Study of the Soviet Ferrous Metals Industry," Working Paper, Wharton Econometric Forecasting Associates, Centrally Planned Economies Projects, October 1982, Table 25.

[13] See Donald W. Green and Herbert S. Levine, "Soviet Machinery Imports," in J.R. Thomas and V.H. Kruse-Vaucienne (eds), "Soviet Science and Technology," Washington, D.C.: George Washington University, 1977.

[14] See, e.g., the articles by M. Weitzman, Y. Toda, and D.W. Green in Journal of Comparative Economics, Vol. 3, No. 2 (June 1979); also, Padma Desai, "The Rate of Return on Foreign Capital Inflow to the Soviet Economy," in US Congress, Joint Economic Committee, "Soviet Economy in a Time of Change,"vol. 2, Washington D.C.: GPO, 1979, pp. 396–413.

[15] See Philip Hanson, "Trade and Technology in Soviet-Western Relations," New York: Columbia University Press, 1981, Chapter 9.

It is the second question that is of interest here. The possibility of technology transfer actually contributing for a time to growth retardation arises primarily on two accounts. First, it may result from a greater difficulty in mastering the new technology than was expected. This might lead, at least for a time, to a decrease in capacity utilization in an industry, if the new capital was to replace some old capital and the old capital was retired. Or if the old capital was kept in operation longer than intended (while waiting for the new technology to be mastered), it may lead to a decrease in the growth of the productivity of labor that worked with it, in a similar manner to the case of long capital gestation periods, discussed previously.

Second, it is said that technology transfer might contribute to a growth slowdown through what is called the resource demanding effect. Imported technology, in the Soviet economy, is most often designated for economically and politically important projects. This is particularly true in the case of importation of turn-key plants. Given the high priority nature of these projects, resources, especially the high quality human and material resources required by advanced technology projects, are diverted from elsewhere in the industry concerned to these projects to increase the possibility of their success. With the build-up of imported machinery and equipment in the first half of the decade, plus the general increase in the level of capital utilization in that period, the slack that may have existed in the other enterprises is diminished, increasing the intensity of the resource demanding effect. Thus, in the second half of the decade, when resources are diverted to the imported technology projects, productivity elsewhere in the industry may be significantly affected. The slower than planned mastering of the new technology and the resource demanding aspects of these high priority projects interact, and their impact, during a transition period until the new technology is sufficiently mastered, may actually contribute to a deterioration of output and productivity growth in some branches of industry. And this, in turn, may have a spread effect for a while on other branches through disruptions in material supply.

4. SYSTEMIC ELEMENTS

The relationship of the Soviet system of economic organization, planning, and management to the efficiency of the Soviet economy is well documented in the literature, both in the West and in the East. These deficiencies have, however, existed for a long time, and have contributed to low Soviet productivity for a long time. The problem for us here is to identify what aspects of these systemic features could be said to have contributed to the downturn in productivity growth, specifically in the second half of the 1970s. There are several that we will discuss. But, before going on to them, it should be noted that the set of systemic defects has a general impact on productivity growth in our period. It limits the ability of the economy to respond in a flexible and effective manner to the other strains that we have identified as contributing to the slowdown of productivity growth.

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[16] This question is explored in Goldstein, op cit., using the ferrous metals industry as a case study.

A. Systemic effects in a maturing economy

As the Soviet economy matures, a number of aspects of the systemic effects become an increasing constraint on productivity growth. There are several examples of this. First, as any industrial economy matures and the capital-labor ratio increases, technological change becomes an increasingly important source of productivity growth. Thus, the impact of the well-documented barriers to innovation that exist in the Soviet system build up over time and may be said to be more deleterious to productivity growth in the period under review than it was in previous periods. Second, in a developed economy, many activities and programs which are required to improve efficiency and productivity growth involve interbranch relationships and coordination. The Soviets have talked about such "specific purpose programs" and "territorial-industrial complexes" which require inter-ministerial coordination and administration, but the existing system of branch ministerial organization has resisted such changes. And third, as an economy grows in size and sophistication, centralized planning and control become more difficult and errors have more of an effect. The centralized supply system in the Soviet economy intensifies these problems by reducing the ability of decision-makers at the periphery to respond flexibly to errors and imbalances in the economy. Furthermore, the fact that prices in the years 1976-1980 were far removed from their price base of 1967 may have added some further distortions in the use of resources in the economy.

B. Plan and labor discipline

There are growing indications in the 1970s of a softening of discipline in the economy. On a number of occasions, Brezhnev condemned the weakening of discipline, especially of plan discipline. In his Report to the 26th Party Congress, he stated: [17]

> The importance of discipline, the importance of personal responsibility have increased many times over in present-day conditions. . . . The first point I want to speak about is responsibility for State plan fulfillment. . . . The plan is law because only its observance assures the harmonious functioning of the national economy. Let us speak frankly: this axiomatic truth has begun to be forgotten. The practice of downward plan revision has become widespread. Such a practice disorganizes the economy, demoralizes personnel, and accustoms them to irresponsibility. . . . Is it not too often that we follow the lead of those who would like to make their lives easier—be listed as leading workers and receive bonuses without actually fulfilling plans.

In a remarkable recent article, a Soviet economist presented data from research he had conducted on annual plan changes and plan fulfillment of about 175 producing units over the nine-year period 1970-1978.[18] Of his almost 1,600 observations, 63 percent involved significant changes in the plan, during the plan year; 37 percent were decreases in plan targets, and 25 percent were increases in plan targets. Failure to achieve plan fulfillment was reported in only 6 percent of the cases, whereas in actuality, 32 percent of the cases failed to fulfill the original versions of their plans.

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[17] L.I. Brezhnev, "Report of the Central Committee of the CPSU to the XXVI Congress of the Communist Party of the Soviet Union" (Feb. 23, 1981), Moscow: Novosti Press, 1981, pp. 65-66.

[18] V. P. Khaikin, "Analiz sostoyaniya planovoi distsipliny na predpriyatakh," Ekonomika i matimaticheskie metody, vol. XVI, No. 5, 1980.

The weakening of labor discipline has also been a much discussed issue: [19]

> It is difficult to find a subject, more animatedly discussed in any conversation on the pressing problems of production, management, social life, than that of labor discipline.

This quote begins a report of a survey of its readers, conducted by the editors of the Novosibirsk journal, EKO, on the subject of labor discipline.[20] Respondents indicated great concern for the decline in labor discipline. Some attributed the decline to excessively lenient laws, but more attributed it to the shortage of labor which has reduced the manager's ability to discipline workers or his willingness to discharge loafers. "It is from here that the harmful liberalism is derived." [21] Also cited are weaknesses in the system of economic management.

The effect on productivity growth of the putative decline in plan and labor discipline may well be significant. For the Soviet economic system, in the absence of effective decentralized mechanisms, can be said to need discipline—the obeying of plans and commands from superiors—in order to function effectively.

C. The second economy

The second economy, which according to indications has grown substantially in the 1970s, has a number of possible effects on the growth of productivity (in the first economy), both real and statistical. The basic effect is that it deflects effort and materials from the first economy, reducing the growth of labor and capital productivity there. But, to a certain extent that may be more statistical than real. For what happens is that reported output is reduced, but not reported inputs. thus, reported productivity growth is reduced. If the output of the second economy were included in official statistics, the effect on productivity growth would be reduced.

There are two additional effects of the second economy worth noting here. One, theoretically it could be argued that the growing supply of goods for sale in the second economy should increase people's incentive to earn money and thus their incentive to work harder in the first economy. On the other hand, the growth of a second economy undermines respect for government and for its laws and regulations, and it erodes the moral climate of a society. This leads to decreased work effort in the first economy and lower productivity growth.

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[19] "Distsiplina truda v. dinamike," Ekonomika i organizatsiya promyslennogo proizvodstva, (EKO), No. 9, September 1981, p. 18 (An abstract of this article appears in Current Digest of the Soviet Press, XXXIV: 2 (February 10, 1982), pp. 7-9).

[20] Ibid., pp. 18-45.

[21] Ibid., p. 25.

III. CONCLUSION

We have identified, categorized, and discussed a number of leading candidates for important causal factors of the deterioration of productivity growth in the Soviet economy in the second half of the 1970s. There are, however, two general, pervasive factors which do not fit easily into the cagetories we have constructed, and which interact with and intensify the causal factors we have discussed. These are, first, tautness, and interindustry balance; and second, disillusionment with the system.

1. TAUTNESS AND INTERINDUSTRY BALANCE

In his recent book, the Hungarian economist Janos Kornai argues that chronic shortage is the normal condition of the socialist economy, that it is an integral, systemic aspect of socialism.[22] The socialist firm, he states, has a soft budget constraint. Usually it can get higher prices from its customers, and when necessary it can get easy credits, grants, and tax exemptions from the state. As a consequence its survival and growth does not depend on its revenue covering its costs; but does depend on its ability to procure more inputs, reserves and productive capacity. Under such conditions, Kornai asserts, the demand of the socialist firm for material, labor, and capital inputs is insatiable. This unconstrained demand of the firm sucks out resources from the producers' goods sector, and to a substantial extent, from the consumers' goods sector, leading in time to the erosion of slack and the creation of chronic shortages, bottlenecks and tautness in the socialist economy.

It would appear that this process may have been at work in the Soviet economy in the 1970s, intensifying the impact of the growth retarding factors we have identified and in this way contributing to the slowdown in productivity growth.

Related to the issue of tautness and the erosion of slack in the economy, is the dramatic change in investment policy introduced in the Tenth Five-Year Plan. A spirited debate is now underway in the Soviet economic literature over the policy of sharply reducing the growth of investment. Defenders of the policy, argue (as discussed above) that too high a growth of investment in the past led to a proliferation of investment projects, long gestation periods, and the excessive growth of the stock of unfinished construction.[23] What is necessary to improve the situation is slower growth of investment, with an emphasis on the renovation and modernization of the capital stock at existing enterprises.[24]

The opponents of the new investment policy argue that the decreased growth of investment (inded, in real terms, the decrease in investment) in the second half of the 1970s ignored and disrupted the required interindustry balances in the economy.[25] Their argument is based on the concept of the "investment complex" and its role in economic growth, and relates to the investment, capital formation, increase in productive capacity, and capacity utilization chain. The investment complex is the group of economic sectors involved in the process of capital formation. It includes the metals, machine building, and construction-materials industries, the construction and installation sector and also the project planning and associated applies research organizations. The opponents assert that to maintain economic growth and the growth of productivity, the productive capacity of the investment complex must maintain a high rate of growth. In the two articles cited, data are provided which show that in the first half of the 1970s the utilization of capacity increased, and by 1975, about half of the branches of industry (which were surveyed) were operating above 93 percent of rated capacity, which historically has been a critical threshold level of utilization. Thus, the economy was fairly taut, with little reserve in hand. To lower the growth of investment at that time created great disruptions in the economy, because as those enterprises in the core of the investment complex came down from above their capacity utilization threshold, the required interindustry relations were disrupted causing other enterprsies, even those operating below the threshold, to decrease their utilization of capacity. That is, they had the labor and capital to operate at higher levels of capacity utilization, but they did not have the required through-put of materials. The absence of sufficient investment resources, due to the low investment growth policy, prevented economic officials from attacking these bottlenecks by increasing their productive capacities.

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[22] Janos Kornai, "Economics of Shortage," vols. A and B, Amsterdam: North Holland, 1980

[23] See, e.g., D. Chernikov, "Intensifikatsiya i sbalansirovannost'," Ekonomicheskaya gazeta, No. 10, March 1981, p. 10; and A.F. Andreev, "Investitsionnaya politika i sbalansirovannost' narodnogo khozyaystvo," Ekonomika i matimaticheskie metody, vol. XVIII, No. 5, 1982, pp. 776–83.

[24] For a strongly critical analysis of the renovation and modernization program, see Boris Rumer, "Soviet Investment Policy: Unresolved Problems," Problems of Communism, September-October, 1982, pp. 53–68.

The problem was further exacerbated by the rapid rise in the share of investment going to the oil industry especially after 1977. This share rises from 10.4 percent of investment in industry in 1977 to a level of 14.3 percent in 1980.[26] Boris Rumer argues that this has had the same disruptive effects on the rhythm and balance in the investment sector as did Khrushchev's "Big Chemistry" campaign of the early 1960s.[27] Furthermore, it diverts investment from the machine building industry and other components of the investment complex, where it is sorely needed.

2. DISILLUSIONMENT WITH THE SYSTEM

A final important contribution to the economic malaise of the late seventies is the apparent erosion of Soviet citizens' confidence in their system. This is a rather ephemeral factor with which to deal, but there appears to be some evidence for it.[28] It may well be that the Khrushchev promises of rapid growth and catching up with the United States in meat and milk by 1980 are coming home to roost. They may have built up expectations, especially of those who were growing up at that time (circa 1960), to a level that by the 1970s created great disappointment for many people.[29] This may have contributed to the increase of alcoholism and of mortality rates, in particular of working age males.[30] And, it may have contributed to the decrease in labor discipline and the decrease in growth of labor productivity.

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[25] See, e.g., K.K. Val'tukh, "Investitsionnyy kompleks i intensifikatsiya proizvodstva," EKO, No. 3, March 1982, pp. 4-31; and N.N. Baryshnikov and B.L. Lavrovskiy, "Moshchnosti i reservy," ibid., pp. 31-50.

[26] Narodnoe khozyaystvo v 1977, p. 354; Narodnoe khozyaystvo v 1980, p. 338.

[27] B. Rumer, loc. cit., p. 67.

[28] See, e.g., John Bushnell, "The New Soviet Man Turns Pessimist," Survey, vol. 24, No. 2, Spring 1979, pp. 1-18.

EPILOGUE

As stated at the outset, this paper is in the nature of an introduction to a study of the productivity growth retardation in the Soviet economy in the period of the 10th Five-Year Plan, 1976–1980. It has been devoted to a cataloguing and discussion of the possible causes of this growth deterioration. The task that lies ahead in our study is to evaluate the contribution of these various causal factors to the productivity slowdown.

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[29] On the relationship between expectations and dissatisfaction, see Richard Easterlin, "Does Money Buy Happiness?" Public Interest, No. 30, 1973, pp. 8-9.

[30] See, e.g., Murray Feshbach, "Population and Labor Force," in A. Bergson and H.S. Levine (eds.), op. cit.

SOURCES OF LOW PRODUCTIVITY IN SOVIET CAPITAL INVESTMENT

By Stanley H. Cohn*

CONTENTS

		Page
I.	Summary	169
II.	Background	170
	A. Trends in investment	170
	B. . . . And productivity	172
III.	Influences on captial productivity trends	174
	A. Investment priorities	175
	B. Retirement policy	177
	C. Replacement investment policy	181
	D. Factor proportions balance	183
	E. Performance in production of technologically advanced producer durables	186
	F. Topics discussed by summaries	188
IV.	Future trends and influences	188
	A. Structural change	188
	B. Energy constraints	189
	C. Retirement imperatives	190
	D. Replacement investment	190
	E. Unfinished construction	191
	F. Modernizing the machinery production profile	191
	G. Factor proportions balance	192
	H. Socially oriented investment	192
	I. Consumer oriented investment	193

I. SUMMARY

In an era of declining availability of manpower and increasing stringency of investment resources it becomes imperative for the Soviet economy to stress improved productivity of its major factor inputs—labor, capital, and organization. This study focuses on productivity of capital. Although Soviet labor productivity trends have been about average when compared with those for the major market economies, capital productivity trends have been conspicuously dismal. For the past 20 years they have been consistently negative.

The choice of investment priorities, though seemingly capital-intensive, has not depressed productivity performance, as indicated by the close similarity of Soviet and U.S. capital-output co-efficients. A major contributor has been asset retirement policies. On the average, fixed assets have been retained in service twice as long as those in the major market economices. This prolonged retention of obsolescent low productivity capital has been reinforced by the low proportion of investment devoted to replacement of obsolescent assets. In recent years the replacement share has been about a fifth, compared with nearly half in the United States. Together these two policies account for about half of the negative capital productivity trend rate.

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*Professor of Economics, State University of New York at Binghamton. The study, as presented in this contribution, has been shortened from its original version in two aspects. Three topics—unfinished construction, capital repairs, and statistical bias—are present in summary form. The statistical appendixes, which present the detailed investment and capital stock time series, together with a methodological explanation, are not included. Copies of the full versions of the summarized topics and of the statistical time series are available upon request to the author.

Productivity has also been depressed by the rapid additions to capital stock compared with additions to employment. In addition, industrial investment has neglected mechanization of auxiliary supporting operations in favor of direct production activities. This mechanization imbalance reduces productivity of both labor and capital.

These inefficient policies of capital usage have been compounded by the inability of Soviet machinery industries to produce the high technology machinery and equipment required to realize the productivity gains from a heavier emphasis on replacement investment. This poor production performance can be explained by a combination of incentives and structural deficiencies. Productivity of capital has been further lowered by the rising proportion of investment immobilized in uncompleted construction projects.

During the decade of the 1980s, external circumstance will further exacerbate the productivity challenge. The stress on energy investment skews investment toward the most capital-intensive sectors. Implementation of environmental protection and industrial health and safety measures will divert investment from its most productive potential uses. Increasing energy constraints may lead to under utilization of fixed capital. Finally, any belated recognition of consumer investment needs will also steer investment toward such capital-intensive sectors as housing and highway construction.

These unfavorable exogenous influences show little likelihood of being offset by improvements in existing investment practices. There has been little inclination to raise retirement rates or to significantly increase the replacement investment share in the ongoing Eleventh Five Year Plan. Only cosmetic solutions have been offered to overcome the inability of the machinery industries to produce technologically advanced equipment. No significant mechanization of auxiliary industrial activities is contemplated. With the labor supply prospect the tightest ever, there is no possibility of reducing the high incremental capital-labor ratio. Finally, little progress has been made in reducing the high proportion of unfinished investment.

II. BACKGROUND

A. TRENDS IN INVESTMENT . . .

Since the 1950s there has been a steady decline in the USSR in the rates of growth of employment, investment, and capital stock. This trend has accelerated since the mid-1970s and shows little prospect of improvement. The rate of growth of investment, in particular, has declined dramatically from an average annual rate of about 13 percent in the late fifties, to about 7½ percent in the late sixties, to less than 4 percent since 1975. The lowest growth in the history of Soviet investment—2.1 percent—has been announced for the Eleventh Five-Year Plan (1981–85).

In the early 1950s, an overwhelming proportion of investment—about 70 percent—was for new plant construction (see Table 1). This was justified by the need to build up postwar production capacity as rapidly as possible and by conditions of abundant labor which made it possible for investment in new facilities to be complemented by fresh increments of manpower. In the ensuing years, growth of new plant investment lagged behind that of investment in machinery (producer durables) and fell off sharply after 1975 to a compounded rate of about one percent a year (see Table 2). By contrast, investment in producer durables has grown rapidly in all periods. As a result producer durables now constitute about 36 percent of total investment compared with 24 percent in the early 1950s.

TABLE 1.—U.S.S.R.: SHARES OF TOTAL FIXED INVESTMENT

Period	Construction-installation	Producer durables	Other
1951–55	69.6	24.4	6.0
1961–65	65.6	27.8	6.6
1966–70	62.8	30.8	6.4
1971–75	60.4	31.5	8.1
1976–79	54.9	35.6	9.5

Source: Appendix A.

TABLE 2.—U.S.S.R.: AVERAGE ANNUAL GROWTH RATES FOR COMPONENTS OF INVESTMENT

Period	Construction-installation	Producer durables	Total investment
1956–60	12.6	12.0	12.9
1961–65	4.0	11.1	6.3
1966–70	7.2	7.6	7.6
1971–75	5.9	8.9	6.9
1976–79	1.3	7.0	3.7

Growth in investment in producer durables will continue to outpace plant investment as Soviet planners emphasize an "intensive" strategy of economy growth. Faced with growing manpower contraints and rising material costs, the USSR is forced to squeeze more output out of existing assets and to substitute labor-saving capital for scarce manpower, and capital-saving (technologically advanced) machinery for obsolescent capital stock. A rising share of producer durables in the investment mix should have a positive effect on the productivity of capital since the return to capital is generally higher for producer durables than for the longer-lived plant component.

Change in the composition of capital stock has paralleled changes in the composition of investment, but more slowly because plant assets are longer lived than producer durables (Table 3).[1] The durables share has risen rapidly even though the plant share has declined slowly because the proportion of other assets, mainly livestock, has fallen substantially. Therefore, the changing composition of capital stock has also been favorable for productivity advance.

TABLE 3.—U.S.S.R.: COMPOSITION OF TOTAL FIXED CAPITAL STOCK

[Percent of total]

Period	Plant	Producer durables	Other
1957–60	74.8	19.6	5.6
1961–65	74.7	20.7	4.6
1966–70	73.6	22.5	3.8
1971–75	71.4	25.1	3.4
1976–79	70.2	26.5	3.3

Source: Appendix B.

B. . . . AND PRODUCTIVITY

Soviet productivity performance during the past two decades has been mixed. In Table 4, which compares average annual rates of growth of both capital and labor productivity over the period 1959–79, it may be noted that labor (manhour) productivity in most economic sectors and for the economy as a whole was growing, although at a steadily declining rate, before virtually collapsing after 1975. By contrast, capital productivity growth has been negative in all periods, with only minor fluctuations from period to period. Thus trends in labor productivity have only recently become critical while trends in the productivity of capital have remained chronically adverse. Moreover, the picture is not improved when the growth of labor and capital are considered jointly. Growth in combined factor productivity during the period 1959–77 has been negative for all economic sectors except transportation and communications and for most industries.

TABLE 4.—U.S.S.R.: TRENDS IN CAPITAL AND MAN-HOUR PRODUCTIVITY BY PERIODS, 1959–79

[Annual average percentage changes]

	Captial productivity				Manhour productivity			
	1959–65	1966–70	1971–75	1976–79	1959–66	1966–70	1971–75	1976–79
Industry	−4.2	−2.2	−2.8	−3.3	3.8	3.2	4.1	1.6
Agriculture	−4.9	−4.3	−8.0	−5.2	3.4	3.2	1.5	0.7
Construction	−6.2	−6.3	−5.5	−6.1	3.7	1.1	2.4	0.8
Transportation and communications	−0.2	−0.1	−1.2	−3.6	4.9	4.2	3.6	1.2
Trade	−4.9	−1.9	−3.3	−4.3	1.2	2.0	1.3	0.9
Services	−5.3	−0.4	−1.7	−1.7	−0.1	0.4	0.3	....
Branches of industry:								
Ferrous metals	−3.5	−3.5	−3.4	−3.6	3.9	3.0	3.9	0.7
Fuels	−1.0	−2.2	−2.3	−3.4	7.8	4.8	6.3	3.2
Machinery	−3.0	−2.7	−1.6	−2.7	2.9	2.9	5.3	3.7

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[1] There is a classification shift in the treatment of equipment installation by Soviet statisticians which affects the comparison of the investment and capital stock time series. Installation is classified under construction in investment statistics, but under equipment in capital stock investment statistics. See V. Zeitsev, "Sovershenstvovanie Planirovaniya Kapitalnykh Vlozhenii", Ekonomicheskie nauki, November 1979, p. 34.

TABLE 4.—U.S.S.R.: TRENDS IN CAPITAL AND MAN-HOUR PRODUCTIVITY BY PERIODS, 1959–79—Continued

[Annual average percentage changes]

	Captial productivity				Manhour productivity			
	1959–65	1966–70	1971–75	1976–79	1959–66	1966–70	1971–75	1976–79
Chemicals	−5.5	−3.1	−0.9	−4.7	2.7	3.2	6.3	1.3
Forest products	−8.1	−4.5	−5.0	−4.8	3.2	2.2	3.2	0.4
Construction materials	−6.8	−3.0	−3.4	−3.4	5.1	2.3	3.5	1.4
Light industry	−5.3	−2.3	−4.9	−3.3	3.0	3.7	2.7	1.6
Food processing	−4.7	−1.4	−3.4	−3.3	4.4	2.7	3.2	0.5
Manufacturing and mining	−4.5	−2.0	−3.2	−3.6	3.7	3.2	4.0	1.5
Electric power	−1.3	−2.2	−0.2	−0.2	4.3	4.3	5.5	2.3
Economic Aggregates:								
Material production sectors	−4.2	−2.3	−4.4	−3.5	4.4	4.0	2.7	1.9
Economy	−3.4	−1.9	−3.8	−2.9	3.8	3.4	2.3	1.3

Sources: See table 6.

Soviet productivity trends compare unfavorably with those of most Western countries. From 1960 to 1973 Soviet labor productivity (output per worker) grew at an average annual rate of less than 2 percent—the lowest of any of the industrialized countries. Since 1973, its growth has been below that of France, Germany, and Japan (see Table 5).

TABLE 5.—COMPARATIVE TRENDS IN LABOR AND CAPITAL PRODUCTIVITY

[Average annual percentage rates of change]

Country	Labor productivity [1]		Capital productivity [2]	
	1960–73	1974–78	1960–73	1974–78
United States	3.1	1.4	0.3	−0.7
France	5.9	4.0	0.7	−1.7
Germany	5.8	4.2	−1.6	−2.3
United Kingdom	3.8	2.0	−1.0	−2.9
Italy	7.8	0.9	0.9	−1.2
Japan	9.9	3.6	−1.4	−3.4
U.S.S.R.	3.7	2.3	−3.2	−4.5

[1] Defined as output per man years of employment in business sectors of market economies and non-service sectors of the Soviet economy.

[2] Defined as output per unit of fixed business capital in market economies and per unit of productive capital stock in the Soviet economy.

Sources: Market economies—estimates of John W. Kendrick prepared for New York Stock Exchange study, "U.S. Economic Performance in a Global Perspective," 1981. USSR—See source references for table 6.

Comparisons of capital productivity growth are even less flattering. Soviet capital productivity has been falling at a faster rate than that of any major Western country since 1960. Compared with the United States alone, the Soviet performance is inferior in every economic sector and industry; negative trends are commonplace in the USSR, while they are exceptional in the United States (see Table 6).

TABLE 6.—U.S.S.R. AND UNITED STATES: COMPARISON OF GROWTH RATES FOR LABOR, CAPITAL, AND JOINT FACTOR PRODUCTIVITY

[Average annual percentage rates of change]

	U.S.S.R.: 1959–79			United States: 1948–76		
	Labor [1] productivity	Capital productivity	Joint factor [2] productivity	Labor [1] productivity	Capital productivity	Joint factor [2] productivity
Ferrous metals, U.S.S.R.	3.0	−3.6	−1.6			
Primary metals, U.S.				0.7	−2.4	−0.1
Fuels, U.S.S.R.	5.7	−2.3	0.2			
Petroleum, U.S.				3.8	0.8	2.1
Machinery	3.7	−2.7	1.1	2.9	0.4	2.7
Chemicals	3.7	−3.8	−1.4	3.5	1.5	2.8
Forest products	2.4	−6.1	−1.3	3.0	1.2	2.3
Construction materials	3.2	−4.4	−0.8	2.0	−0.8	1.3
Light industry	3.7	−4.2	0.4	3.2	−0.1	2.6
Food processing	2.8	−3.4	−0.4	3.3	1.8	2.8
Manufacturing and mining	2.9	−3.5	−0.4	3.2	0.3	2.0
Electric power, U.S.S.R.	3.2	−1.3	−0.7			
Public utilities, U.S.				4.6	1.4	3.0
Economic sector:						
Industry	3.3	−3.3	−0.2	3.5	0.4	2.1
Agriculture	2.4	−5.8	−0.5	5.0	−0.2	3.1
Construction	2.7	−6.4	−2.4	1.0	−2.3	1.0
Transportation and communications	1.7	−1.2	1.2	3.7	1.4	3.2
Trade	1.4	−3.8	−0.6	2.4	0.3	2.0
Services	0.2	−2.5	−0.7	2.3	0.1	1.6

[1] Output per man hour.
[2] Labor and capital combined.

Sources: U.S.S.R.: Manhours—Stephen Rapawy, "Civilian Employment in the U.S.S.R.: 1950 to 1978." FDAD, February 1980. Capital—see App. B. Production—National Foreign Assessment Center, "Handbook of Economic Statistics, 1981."

United States—John Kendrick and Elliot Grossman, "Productivity in the United States: Trends and Cycles," Johns Hopkins Press, 1980.

Methodology: Joint Factor Productivity for U.S.S.R.: Based upon factor income shares in Central Intelligence Agency, "U.S.S.R.: Gross National Product Accounts, 1970," A (ER) 75–76, November 1975, Table C–2. Joint Factor Productivity for U.S.—Direct calculations of Kendrick and Grossman.

Indeed, the USSR's record with respect to capital productivity is really extraordinarily poor and difficult to explain on traditional economic grounds. When capital stock grows more rapidly than manhours of employment, the productivity of labor tends to rise more rapidly than the productivity of capital, and this generally has been the experience of industrial economies. Market economies however, have not experienced such persistently adverse capital productivity trends. Negative trends such as those exhibited in the USSR imply falling rates of return to investment. In a market economy falling rates of return would trigger a reduction in investment and hence in the accumulation of capital stock, thereby arresting the fall in capital productivity. In a market economy, in other words, the Soviet experience would not have taken place.

III. INFLUENCES ON CAPITAL PRODUCTIVITY TRENDS

The poor performance of Soviet capital productivity relative to that of major market economies stems from influences unique to the Soviet system and to their complex interactions. Some of these influences result from conscious policy choices, some from the functioning of particular Soviet institutional arrangements, and some from circumstances external to the system and to specific policies. The influences may be summarized and grouped accordingly:

Influences on Soviet capital productivity

Policy-based: (1) Investment priorities; (2) retirement policies; (3) replacement investment policies; and (4) factor proportions.

Institution-based: (1) Unfinished construction and (2) organization of machinery production.

Exogenous: (1) Statistical bias and (2) capital repairs.

A. INVESTMENT PRIORITIES

In the USSR, investment priorities are centrally determined. That is, the pattern of distribution of investment resources, and hence the structure of capital stock, is set by planners in accord with their preferences, rather than by decentralized economic decision-making based ultimately on consumer preferences as in market economies. Does such a distribution imply an especially capital-intensive approach to economic development?

Available evidence, which indicates that Soviet capital-output ratios are not greatly different from those of the United States, tends to argue against this hypothesis. Table 7 compares "direct" capital-output ratios (hereinafter referred to as capital coefficients) for major economic sector and industrial branches in the US and the USSR.[2] It may be seen from the table that the coefficients are quite close generally, and strikingly close, or identical, in the case of manufacturing and mining, non-industry sectors, and material product.[3]

It is possible, of course, that the numerical closeness of the coefficients is purely fortuitous because of offsetting differences in factor endowments and relative prices in the US and the USSR. Comprehensive comparisons of the price structures in the United States and the USSR indicate that the cost of capital relative to that of labor is lower in the United States than in the USSR and that the level of technology (the physical input of capital relative to that of labor) is higher in the United States.[4] Possibly, the combination of lower US prices for capital and a higher endowment of capital goods have combined to offset the Soviet combination of relatively higher capital costs and a smaller amount of capital goods, yielding capital coefficients of similar magnitude.

TABLE 7.—U.S.S.R. AND UNITED STATES—DIRECT CAPITAL COEFFICIENTS, 1972

[Ratio of values of fixed capital to value of output]

	U.S.S.R.	United States
Branch of industry:		
Ferrous metals, U.S.S.R.		
Primary metals, U.S.	0.84	0.91

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[2] Soviet coefficients are based on the 1972 input-output transactions table and the accompanying capital stock matrix. US coefficients are based on detailed capital stock estimates and the 1972 input-output transactions table. (See Table 6 for sources.) The comparison is limited to "direct" coefficients because the more comprehensive "full" coefficients are not yet available in US data. "Direct" coefficients measure capital requirements to produce a unit of output in a particular sector or branch of industry. "Full" coefficients measure the capital contribution of supplying sectors and branches as well.

[3] Material product is the combined output of the industry, agriculture, construction, transportation and communications, and trade sectors.

[4] See Joint Economic Committee, Congress of the United States, "Gross National Product of the USSR: An International Comparison," forthcoming.

TABLE 7.—U.S.S.R. AND UNITED STATES—DIRECT CAPITAL COEFFICIENTS, 1972—Continued

[Ratio of values of fixed capital to value of output]

	U.S.S.R.	United States
Coal	1.24	1.41
Oil and gas	1.15	1.65
Machinery	.59	.37
Metalworking	.44	.37
Chemicals	.80	.85
Forest products	.49	.59
Construction materials	.59	.85
Light industry	.15	.27
Food processing	.22	.26
Manufacturing and mining	.62	.58
Electric power	3.02	3.41
Industry	.73	.78
Economic sector:		
Industry	.73	.85
Agriculture	1.03	1.41
Construction	.38	.15
Transportation and communication	2.17	2.48
Trade	1.23	.63
Nonindustrial sectors	.99	.98
Material product	.88	.88

Sources: USSR—Foreign Demographic Analysis Division, U.S. Department of Commerce, "The Reconstructed Soviet 1972 Input-Output Table in Producers' Prices."

United States—Bureau of Economic Analysis, U.S. Department of Commerce, "The Input-Output Structure of the U.S. Economy, 1972." U.S. Bureau of Labor Statistics, "Capital Stock Estimates for input-Output Industries: Methods and Data," 1979.

The hypothesis that the Soviets have pursued a highly capital-intensive path of development may also be tested by inquiring if aggregate capital coefficients would drop if capital stock were redistributed according to US weights, reflecting a more consumer-oriented capital stock composition, and thereby, a less capital-intensive one. For this test weighted coefficients were derived for four economic aggregates—mining and manufacturing, industry, non-industry sectors combined, and material product—using disaggregated data on US input-output capital coefficients. If it is true that capital in the USSR is flowing disproportionately to sectors and branches with high capital-output ratios, high capital stock shares will be associated with high capital coefficients to a relatively greater extent when Soviet weights are used, and aggregate coefficients based on Soviet weights will be higher than those based on US weights. Results of the experiment are shown in the tabulation below:

Economic sector/branch	Capital coefficients	
	Soviet weights	US weights
Manufacturing and mining	0.74	0.72
Nonindustrial sectors	1.49	1.40

It may be seen that Soviet weights yield a slightly higher aggregate capital coefficient for both manufacturing and mining and for non-industry sectors combined. The differences using Soviet and US weights, however, are not significant. The results indicate, very crudely, that the decline in Soviet capital productivity is probably not depressed in any significant degree by Soviet investment priorities that favor capital-intensive sectors and branches of industry.[5]

More significantly, can the declining trend in Soviet capital productivity be explained by changes in the structure of the economy? Some Soviet economists appear to think so—though to a minor degree. According to one Soviet economist, structural changes in the economy accounted for one-fifth of the decline in capital productivity during 1951–60, about 4 percent of the decline during 1961–65, and more than 40 percent of the decline during 1966–70.[6] A second Soviet economist asserts that only about one-ninth of the rise in the capital output ratio during 1971–78 is attributable to structural change.[7] The large impact of structural change in the 1966–70 period is said to be caused by the rapid increase in the share of investment allocated to agriculture.

To test the impact of structural changes in the economy, the average annual rates of change in capital productivity for the period 1966–79 for subsectors of two aggregates—"industry" and "material product"—were weighted by Soviet value-added weights for 1966 and 1972.[8] Using "industry" as an example, the hypothesis is as follows: If shifts in the economy have taken place such that production is being concentrated to a relatively greater extent in subsectors with low productivity growth rates, then capital productivity for "industry" will decrease at a faster rate when weighted by 1972 weights.

In the case of "industry", both sets of weights produced similar results. In the case of "material product", capital productivity does not fall as fast if 1972 weights are used, possible because of the reduced weight of agricultural output in the value-added weight for 1972. If agricultural output is adjusted to eliminate the weather factor, the productivity trend for "material product" is unchanged by the use of alternative weights. Hence, changes in the structure of the economy do not appear to have significantly influenced capital productivity, and the cause of the decline must be rooted in other factors.

B. RETIREMENT POLICY

Low rates of asset replacement in the Soviet economy contribute to low capital productivity. When plant and machinery are kept in use too long, production becomes less efficient, outlays for maintenance and capital repair increase, unit production costs rise, and productivity slackens. Under these conditions, productivity falls faster than might normally be the case because the Soviet capital repair necessary to maintain assets in working condition is notoriously inefficient in the use of manpower and machinery.

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[5] The comparison with the United States excludes housing, which has a very high capital coefficient in both economies and a much heavier wieght in the US capital stock. It is excluded because of methodological difficulties in the definition and measure of housing output.

[6] V. V. Kossov, "O Tempakh v. Razvitom Sotsialisticheskom Obshchestve, "Ekonomika i matematicheskiye metody," January 1980, p. 90.

[7] L. A. Bugzets, "Ob Effektivnost' Ispol'zovaniya Osnovnykh Fondov," Finansy SSSR, June 1980, p. 27.

[8] Suitable weights are not available for any year prior to 1966, although an earlier year would be preferable for this kind of test. The statistical quality of the capital coefficients published as a supplement to the official 1959 inter-industry table is inferior to the capital material which accompanied the 1966 and 1972 inter-industry tables.

Furthermore, as manpower constraints become more acute, there will not be sufficient qualified workers to operate the rising volume of productive capital. Already in 1971-75, according to a Gosplan institute, more than 2 million working places could not be adequately staffed, and another million in 1976-78.[9]

Plant and equipment are retired mainly for two reasons: physical wear and tear and obsolescence. Soviet retirement rates for wear and tear are available for economic sectors and branches of industry in officially published data; retirement rates for obsolescence are not generally published. Hence, comprehensive rates of replacement of plant and equipment are not available. As a general rule, official amortization rates cannot be used as surrogates for actual retirement rates. Neither can the reciprocals of these rates (the planned service life of the given class of assets) be taken at face value. Assets tend to be kept in use far beyond their planned service life, so amortization rates overstate the actual rate of assets retirement.[10]

However, it is possible to estimate actual retirement rates from data on capital stock, investment, and unfinished construction when data are available and consistent. The retirement rate is the value of capital stock replaced during time period "t" expressed as a percentage of existing capital stock at the beginning of the period. The calculation consists in finding the difference between gross and net additions to capital stock where gross additions are equal to new investment during time period "t" minus the portion that went into increases in unfinished construction.[11]

The required statistics are available for Soviet industry. Official and estimated retirement rates for industry are shown below:

U.S.S.R.: Retirement rates for industry

Type of retirement rate and time period:	*Rate (Percent)*
Wear and tear (official), 1964-78	1.78
Amortization (official), pre-1975	3.90
Amortization (official), post-1975	4.70
Estimated ("actual"), 1964-79	2.47

The tabulation shows how widely published retirement rates for wear and tear and amortization can vary from "actual" rates. Physical wear and tear understates the "actual" rate of retirements by nearly one-third; amortization rates overstate "actual" retirments by more than one-half before 1975, and by more than 90 percent since 1975.

In cases where available date are not adequate or are inconsistent—most branches of industry, agriculture, transportation and communications, and trade—"actual" retirement rates may be established by a ratio method. Referring to the tabulation it may be seen that for Soviet industry as a whole the retirement rate for wear and tear is about 72 percent of the "actual" retirement rate.[12] This ratio may be applied to published wear and tear rates for the indicated sectors to derive "actual" retirement rates for these sectors. Finally, retirement rates for construction, services, and housing may be computed directly from published data on capital stock balances.[13] Estimated retirement rates for the above sectors of the economy are listed in Table 8 in the "Total Stock" column.

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[9] V.P. Krasovskii, "Tekhnicheskoe pervooruzheniye proizvodstva i effedktivnost' remonta," Voprosy ekonomiki, July 1981, p. 35-39.

[10] One Soviet economist asserts that actual retirement rates are significantly lower than published amortization rates. See, T. S. Khachaturov, Effektivnost' kapital'nykh vlozhenii, 1979, p. 46.

[11] According to the following formulation: $R = I_t - (UC_t - UC_{t-1}) - K_t - K_{t-1})/K_{t-1}$

Where:

R = the retirement rate.
K_t = existing capital stock at the close of the period.
K_{t-1} = existing capital stock at the beginning of the period.
I_t = new investment.
UC_t = unfinished construction at the close of the period.
UC_{t-1} = unfinished construction at the beginning of the period.

The foregoing discussion concerned retirement rates for plant and equipment as a whole. It is desirable also to estimate retirement rates for these major components of capital stock, separately. This may be done in two ways. For branches of industry, wear and tear retirement rates are available for plant and for equipment. The ratio of these two rates can be applied to the retirement rate of total capital stock to derive separate estimates of the "actual" retirement rate of plant, and equipment, respectively. A somewhat different method was used for agriculture, construction, transportation and communications: retirement rates for producers durables were taken directly from Soviet sources,[14] and the rates for the plant component were derived as residuals. For the trade sector, the ratios for industry as a whole were used. Retirement rates for plant and equipment components of the capital stock are shown in Table 8.

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[12] This discrepancy between official industry retirement rates and calculated rates, which include obsolescence, is confirmed by similar estimates by a Soviet economist for the 1962-71 period. Ya. Kvasha. "Tekhnicheskii progress, sroki sluzhby sredstv truda i otraslevaya struktura," in Proportsii vosproizvodstva v period razvitogo sotsialisma, Nauka, 1976, p. 131.

[13] Given for the year 1974 in the 1974 edition Narodnoye Khozyaystvo, p. 82.

[14] See Table 8 for sources.

TABLE 8.—U.S.S.R.: RETIREMENT RATES FOR CAPITAL STOCK AND MAJOR COMPONENTS, 1964–79

[Retirements as percent of capital stock at beginning of the year]

	Total stock	Plant	Producer durables
Branch of Industry:			
Electric power	0.93	0.36	1,19
Fuels	4.22	2.51	7.08
Coal	9.26	4.08	16.63
Oil	2.36	1.22	4.86
Gas	2.01	1.75	2.32
Ferrous metals	1.52	0.69	2.32
Chemicals	1.80	0.62	2.85
Machinery	2.00	0.61	3.35
Forest products	5.32	2.84	8.46
Construction materials	4.04	1.51	7.47
Light industry	3.40	0.95	6.02
Food processing	2.91	1.15	4.53
Economic sector:			
Industry	2.47	1.15	3.68
Agriculture	5.56	2.58	7.63
Construction	5.95	3.28	7.58
Transportation and communication	1.62	1.02	2.38
Trade	2.99	1.39	4.55
Services	1.33	(1)	(1)
Housing	1.00	(1)	(1)

(1) Not available.

Sources: Official retirement rates—
Industry—annual issues of Narodnoe khozyaystvo SSSR
Agriculture, transportation and communication, trade: S.V. Belova, Fond vosmeshcheniya sredstv truda i dinamika podrazdeleniya, 1977, p. 133.
Construction, services, and housing—Narodnoe khozyaystvo SSSR v 1974 godu, p. 82.
Relationship of asset component retirment rates to sector and industry branch rates—
Industry—annual issues of Narodnoe khozyaystvo SSSR for 1974 to 1978.
Agriculture, transportation and communication, construction—Yu. V. Kurenkov, D.M. Palterovich, Tekhnicheskii progress i optimal 'noe obnovlenie proizvodstvennogo apparata, 1975, p. 48.

Soviet retirement rates for plant and equipment are low relative to offfical Soviet standards (amortization rates) and low relative to retirement rates of major Western countries (see Table 9). It may be seen that up to 1975, Soviet plant was retired at a rate 20 percent below that implied by official amortization rates, and producers durables at a rate only one-third the official rate. Actual retirement rates compared with official rates are even lower for years after 1975. Compared with the average rate of retirement for Western countries, "actual" Soviet rates are on the order of two-fifths the Western average for both plant and producers durables. The Soviet rate for housing is less than half the Western rate.

Using average Western retirement rates as the norm for an economically desirable replacement policy, it is possible to assess, roughly, the effect of low Soviet retirement rates on changes in capital productivity in the economy during 1959–78. Let us postulate that the Soviet rate should have been double the "actual" rate (to bring them into line with Western rates), and that the average productivity of assets replaced under this higher rate was half that of all assets. Under these assumptions, capital productivity would have declined at an average annual rate of 2.4 percent instead of the estimated 2.9 percent during 1959–78.

Thus, it may be concluded that a more liberal retirement policy would have slowed the negative trend in capital productivity—in quite impressionistic terms by about one-half a percentage point a year. While significant, the negative trend in captial productivity has been so strong that more rapid depreciation of fixed assets would still have accounted for less than one-fifth of the average rate of decline of the overall output-capital ratios in the economy.

TABLE 9.—COMPARATIVE FIXED ASSET RETIREMENT RATES

[Retirements as percent of capital stock at the beginning of the year]

Country	Nonresidentail plant	Producer durables	Housing
Germany	3.7	10.2	2.5
France	5.7	12.5	2.5
Italy	4.0	11.1	1.7
United Kingdom	2.5	7.3	2.5
Canada	4.2	9.0	2.5
United States	3.3	8.5	1.7
Average	3.9	9.8	2.2
U.S.S.R. (actual)	1.5	4.1	1.0
U.S.S.R. (official lives)[1]	1.8–2.0	6.6–1.0	1.0

[1] Ranges reflect pre-1975 and post-1975 retirement rates.

Sources: Germany, France, Italy, United Kingdom, Canada—Laurits Christensen, Dianne Cummings, Dale Jorgenson, "Economic Growth, 1947–1973: An International Comparison," New Developments in Productivity Analysis," National Bureau of Economic Research, 1980.
United States—U.S. Department of Commerce, "Fixed Nonresidential Business Capital in the United States, 1925–75", NTIS, 1976.
U.S.S.R.—Derived from Table 8.

C. REPLACEMENT INVESTMENT POLICY

Soviet planners are acutely aware that the role of replacement investment must be increasingly emphasized.[15] Under modern conditions, replacement is a major means of introducing technological change into production. New assets tend to be technologically more advanced and productive than assets being replaced.

In the Tenth Five-Year Plan (1976–80), for example, replacement of obsolete capital stock was given priority over construction of new plants in the older industrial regions of the country. However, this goal was only partially reflected in the actual provisions of the Plan. That is, the share of industrial investment that went to replacement of existing assets was increased to only 23.6 percent, compared with an actual share of 20.2 percent for the Ninth Five-Year Plan (1971–75).[16] In fact, for the first three years of the Tenth

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[15] The definition of replacement investment used in this study differs from the conventional understanding of the term used in macroeconomic theory. As used herein, the asset which is substituted for the displaced obsolescent asset is assumed to be more technologically advanced than the old asset. Conventional economic theory makes no assumption of technological improvement, but assumes that the thrust of technological advance occurs through the medium of new plant and equipment, rather than through the substitution of new assets for old. Its focus is depreciation rather than technology. By contrast, the concept of replacement in this study is a technological one.

In Soviet statistical reporting investment alternatives to new construction are divided into three classifications: expansion (rasshirenie), reconstruction (rekonstruktsiya), and retooling (tekhnicheskoe perevooruzheniye). Only the two latter categories fall within the definition of replacement investment, as used in this study. They are synonymous with replacement investment in plant and producer durables, respectively. The concept of expansion refers to additions of plant and durables to existing facilities and would, thereby, fall within the category of new investment. The bulk of Soviet estimates of replacement investment combine all three categories, of which expansion is by far the largest. For official definitions see "Instruktivnoe pis'mo Gosplana SSSR i Gosstroya 1975 god", No. VI-4-D, Biulletin' normativnyk aktov ministerstv i vedomstv SSSR, 1975, no. 5 pp. 47–48.

[16] V. Dubrovskiy, "Tekhnicheskoe pereoruzhenie destvuyushchikh predpriyatii," Voprosy ekonomiki, February 1980, p. 106.

FYP, replacement investment as a share of total investment was only 19 percent below both the Plan and the level of the previous five years.[17]

The proportion of Soviet investment intended for replacement, both planned and actual, is far below the proportion in the United States, which has stood at about one-half for the past 30 years. A comparision with the United States is, perhaps, not entirely appropriate since US industrial production has been growing more slowly than Soviet production. Nonetheless, the Soviet replacement share is also too small in the judgment of Soviet economists, although opinion varies about how much replacement is needed. One Soviet economist has estimated that in the Ukraine the replacement share is too small by 50–100 percent, and should be increased to 34–40 percent of total investment.[18] Since the Ukraine has an industrial plant somewhat older than the national average, an ideal proportion for the economy as a whole might be on the order of 34 percent. On the other hand, another economist has estimated that the replacement share should be tripled.[19]

Producers durables are being replaced at a far more rapid rate than plant, which is to be expected since they tend to wear out much faster. According to one Soviet source, 9 percent of the investment in plant during 1971–75 was to replace existing plant, whereas 44 percent of the investment in producers durables was earmarked for replacement.[20]

The technological gains from this high share for replacement of durables are overstated because the highest replacement rates were for agricultural machinery and motor vehicles. Technological improvements in agricultural machinery and motor vehicles have been modest over the past two decades, so the replacement of worn out units with new units raised the technological capabilities of user organizations only slightly.[21]

Greater emphasis on replacement investment is justified on several counts. First, specialized surveys have indicated that during the Ninth Five-Year Plan newly activated production capacity resulting from the reconstruction of existing facilities was considerably more productive than new construction. Labor productivity was about 50 percent higher and capital productivity 86 percent higher.[22] Second, replacement investment, compared with new construction, can result in cost savings of one-half to two-thirds, and capacity can be brought on stream 3–3.5 times as rapidly.[23] These data are rough indications of the cost to the Soviet economy of an inadequate replacement policy.

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[17] M.D. Vorobievskiy, "Basic Approaches for Improving Capital Investment Effectiveness in Developing the Construction Materials Industry," Stroyitel'nyye materialy, October 1979 (JPRS translation 74891, "USSR Report: Construction and Equipment," 9 January 1980. p. 22).

[18] P. I. Bagri, Problemy intensivnogo proizvodstva, 1978, p. 181.

[19] Yu.M. Ivanov, "Sootnosheniya extensivnogo i intensivnogo protsessoi vasshirennom vosproizvodstva," Ekonomika, 1980, p. 104.

[20] V. Fal'tsman, "Intensification of Development of the Production Apparatus," Problems of Economics, December 1978, pp. 48 & 55.

[21] D. Palterovich, "Obnovleniya oborudovaniya i tekhnicheskoe perevooruzhovanie proizvodstva," Planovoye khozyastvo, September 1980, p. 103. Agricultural machinery and motor vehicles tend to be poorly maintained, used carelessly, and are ill-equipped for use in areas of inhospitable climate. In addition, spare parts are chronically in short supply, frequently forcing the cannibalization of normally-functioning equipment.

[22] V. P. Krasovskiy, "Investsionnaya politika i rekonstruktsiya," Ekonomika i organizatsiia promyshlonnogo proizvodstva, No. 4, 1979, p. 80.

[23] A. Bryachikhin, "Khozaystvennyi mekhanism v stroitel'stve," Ekonomicheskie nauki, April 1980, p. 90.

We can also estimate, using information above, the impact that a higher level of replacement investment would have had on capital productivity during 1976–80. Given the assumption that replacement raises the productivity of capital by 86 percent more than new construction (the Krasovskiy estimate cited above), then a 50 percent increase in replacement investment (over the 23.6 percent share actually achieved) would have raised the productivity of capital by 10.1 percent; the productivity gain would have been 20.3 percent if the replacement share were doubled. These productivity gains, however, even if achieved over the entire 1959–78 period, would not have eliminated the negative growth in capital productivity. A 10-percent gain in capital productivity would have slowed the average annual rate of change for the 20 years from −2.9 percent to −2.4 percent; a 20-percent gain, to −2.0 percent. If, however, gains in productivity were combined with simultaneous gains from more rapid retirements, as postulated in earlier discussion, it would have been possible for the USSR to arrest the decline in capital productivity by roughly one half.

D. FACTOR PROPORTIONS BALANCE

The negative trend in the productivity of Soviet fixed capital may be explained, in part, by trends in factor proportions—relative rates of growth in man-hours or employment and in capital stock. If growth rates for capital stock are significantly higher than those for employment, diminishing returns to capital may be generated. Although all industrializing economies have increased capital stock more rapidly than man-hours or employment, diminishing returns to capital usually have been offset by technological progress—by increases in the productivity of newly invested capital and by improvements in organizational efficiency—skillful management.[24]

Table 10 compares Soviet and Western growth trends in capital/labor ratios for non-residential output in 1955–70, and for industrial output in 1969–79. In both cases, the rise in Soviet capital/labor ratio has considerably exceeded that in all market economies except Japan.[25]

TABLE 10.—COMPARATIVE TRENDS IN FACTOR PROPORTIONS

County	Employment Index	Capital stock index	Capital stock/exployment	
			Index	Growth rate[1]
Nonresidential output, 1955–70:				
United States	125.7	171.9	136.8	2.1
France	107.8	209.8	194.6	4.5
Germany	119.1	243.0	204.0	4.9
United Kingdom	103.4	172.4	166.7	3.5
Italy	99.6	217.3	218.2	5.3
Japan	124.4	409.0	328.8	8.3
U.S.S.R	130.3	383.1	294.0	7.5

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[24] Technological progress from invested capital is sometime called "embodied" technical change; that which derives from organizational arrangement—"disembodied" technical change.

[25] Since 1969, the growth in capital/labor ratios in France also has exceeded that in the USSR.

TABLE 10.—COMPARATIVE TRENDS IN FACTOR PROPORTIONS—Continued

County	Employment index	Capital stock index	Capital stock/exployment Index	Capital stock/exployment Growth rate[1]
Industrial output, 1969–79:				
United States	127.5	154.8	121.4	2.0
France	98.6	189.5	192.2	6.7
Germany	98.1	149.0	151.9	4.2
United Kingdom	101.4	143.4	141.4	3.5
Italy	105.4	148.8	141.2	3.5
Japan	109.5	236.3	215.7	8.0
U.S.S.R	144.8	225.9	193.3	6.8

[1] Average annual rate.

Sources: Non-Residential Output. Abram Bergson, "Soviet Post-War Economic Development," 1974, Wicksell Lectures—1974. Appendix tables 1 and 5.

Industrial Output. Market Economies: Unpublished estimates of Office of Economic Research, Central Intelligence Agency.

U.S.S.R: See sources for Table 6.

Given such rapid growth in the capital available for each worker, it is surprising that Soviet labor productivity has not grown far more rapidly. For non-residential output, capital per worker has grown nearly twice as fast as output per worker.

The comparison of Soviet and Japanese rates in especially revealing. Japan has been adding capital per worker at a faster rate than the USSR but increasing its output per worker at an even faster rate. Whereas returns to capital in the USSR are diminishing, in Japan they are increasing. This comparison strongly suggests that Japan has been much more successful in adapting to technological change, in assimilating machinery and processes that are technologically advanced. Soviet technology has not advanced rapidly enough to offset the diminishing returns to capital caused by rising capital-labor ratios.

Soviet capital-labor ratios have been growing rapidly across all sectors of the economy and branches of industry. This may be seen from a bilateral US-Soviet comparison (Table 11). Again, the growth in these ratios has far outstripped growth in labor productivity. The assimilation of modern technology evidently is a pervasive problem throughout the Soviet economy.

TABLE 11.—U.S.S.R. AND UNITED STATES: TRENDS IN CAPITAL MAN-HOUR RATIOS

[Average annual percentage rate of growth]

	U.S.S.R. 1959–79	United States 1948–76
Branch of industry:		
Ferrous metals, U.S.S.R		
Primary metals, U.S	6.8	3.3
Fuels, U.S.S.R		
Oil, U.S	8.1	3.0
Machinery	6.4	1.8
Chemicals	7.6	1.9
Forest products	8.6	0.7
Construction materials	7.8	2.8
Light industry	7.1	3.4
Food processing	6.4	1.4
Manufacturing and mining	6.9	2.3
Electric power, U.S.S.R		
Public utilities, U.S	5.5	3.4

TABLE 11.—U.S.S.R. AND UNITED STATES: TRENDS IN CAPITAL MAN-HOUR RATIOS—Continued

[Average annual percentage rate of growth]

	U.S.S.R. 1959–79	United States 1948–76
Economic sector:		
Industry	6.7	2.4
Agriculture	8.6	7.0
Costruction	8.6	3.5
Transportation and communications	5.4	2.6
Trade	5.3	2.1
Services	2.7	2.1

Sources: See Table 6.

The fact that capital-labor ratios are growing much more rapidly in the USSR than in the US appears paradoxical in the light of relative costs of capital and labor in the two economies. In theory, we would expect capital to grown relatively more rapidly in the United States, since capital—compared with the cost of labor—is believed to be relatively cheaper in the United States.[26]

Failure to achieve a greater degree of mechanization of both direct (prodution line) and auxiliary (warehousing, loading-unloading, repair, etc.) production may partially explain why the growth in labor productivity has failed to keep pace with the growth in capital intensiveness. The level of mechanization is low in industry, agriculture, and construction; manual workers account for more than half of all workers in industry, more than 75 percent in agriculture, and about 65 percent in construction.[27] Mechanization is especially low in auxiliary operations in industry; whereas about 33 percent of all workers in basic industrial production are involved in manual tasks, the share is 72 percent in auxiliary activities.[28]

As long as labor was plentiful, the Soviets could ignore investment in the mechanization of auxiliary work in favor of investment directly in production.[29] As the manpower constraint tightens during the 1980s, however, Soviet planners can be expected to look more favorably on the mechanization of auxiliary work, which can release relatively more labor, faster and at less cost than mechanization of basic production processes. Soviet economists have estimated that a ruble invested in auxiliary operations releases 4 to 5 times as many workers as a ruble similarly invested in basic production operations[30] and that the time required to mechanize auxiliary operations varies from six months to two years, compared with five or six years for basic production. In machinery production, it costs from 2,000 to 5,000 rubles to convert one worker in auxiliary operations from manual to mechanized operations, whereas in basic production the cost varies from 8,000 to 10,000 rubles.[31]

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[26] A recent study of ruble-dollar price ratios lends empirical support to this assumption. The study shows that ratios tend to be lowest for those products and services that are the most labor-intensive. See Joint Economic Committee, Congress of the United States, "Gross National Product of the USSR: An International Comparison," forthcoming.

[27] E. Manevich, "Vosproizvodstvo naselenie i isopol'zovaniye trvdovykh resursov," Voprosy ekonomiki, August 1978, p. 42.

[28] V. V. Voskresenskiy and A. A. Maksyurov, "The Effect of Scientific and Technical Progress on Improvement in the Utilization of Capital and Increases in Capital Investment Yield" Mashinostroitel', December, 1979, p. 18.

[29] In market economies, under conditions of comparative labor scarcity, there would be little difference in the degree of mechanization in basic and auxiliary production.

[30] G. Mikheev and N. Markova, "S balansirovannost' rabochikh mesti trudovykh resursov," Voprosy ekonomiki, October 1979, p. 48.

In some areas of auxiliary production, the possibilities for labor saving are enormous—for example, materials handling. This activity, which employs about 13.6 million workers or roughly 18 percent of all production personnel, is only 27 percent mechanized.[32] Further, materials handling constitutes more than one quarter of the total labor cost in production. But the mechanization of materials handling is likely to take place slowly under the best of circumstances because of the prior investment that is needed in sectors of industry that produce materials handling equipment. Production of materials handling equipment is highly dispersed (specialized enterprises account for only 15–18 percent of the output of materials handling equipment), undercapitalized, and competes directly for resources with higher priority sectors of machinery production.[33]

In the short-run, increased mechanization would tend to release labor rather than to increase output because production is limited by the capacity of productive equipment. Labor productivity would rise. The impact on output and, hence, on the productivity of capital, is less certain and would depend, ultimately, upon the uses to which the released labor were put.

E. PERFORMANCE IN PRODUCTION OF TECHNOLOGICALLY ADVANCED PRODUCER DURABLES

Up to this point the duscussion has concerned those forces that influence the demand for investment. The analysis must also consider the supply of machinery required to maintain improvements in capital productivity. In the USSR, organizational deficiencies and inappropriate incentives have hindered technical progress as found in successive generations of machinery.

An appropriate production response mainly requires improvement in the technology of the machinery and equipment used to replace worn-out assets. Technological improvements, however, have been slow in coming. One Soviet economist estimates that only 40 percent of investment used to replace obsolete assets, or to expand existing plant, has utilized new technology.[34] Moreover, a survey by the State Committee on Prices showed that about a third of the newly produced machinery that was said to incorporate new technology (as justification of higher prices than those for similar machinery already in production) actually were not better in quality or efficiency.[35] Indeed, there is some evidence that the rate of improvement of the machinery mix is slowing, with unfavorable implications for capital productivity. In 1967, products introduced within the previous five years represented 55 percent of output; by

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[31] P. Krylov, "Mechanization and Problems in Reducing Manual Labor," Planovoye khozyastvo, October, 1979, p. 47.

[32] A. I. Kovalev, "Mechanization of Materials Handling," EKO, October 1979 (JPRS 74780, "USSR Report: Economic Affairs," 4 January, 1980, p. 58).

[33] Production is scattered in 400 plants under 40 different ministries and departments. A. Kovalev, op. cit., p. 62.

[34] V. I. Poltorygin, "Effektivnost' tekhnicheskogo perevooruzheniya sotsialisticheskogo proizvodstva," 1975, p. 41.

[35] N. Glushkov, "On the Further Improvement of Planned Price Formation and its Effect on Raising of Production and Quality of Work," Planovoye khozyastvo, June, 1980.

1978, the share had declined to 42 percent. During the same period, the share in production of products 10 years or older rose from 16 to 27 percent. Also, many of the newer models did not significantly increase productivity.[36]

In the USSR, machinery production incorporating new technology has been retarded for a variety of organizational and institutional reasons, which, collectively, tend to reduce incentives and constrain managerial initiatives. First, the production of technologically advanced machinery and equipment requires an innovative environment. Soviet producers, however, have a deeply ingrained tendency toward "self-reproduction"—continuing to produce products whose production has been mastered to ensure that customary goals are met and bonuses received.[37] Second, innovation is constrained by taut planning with its short time horizon. Production of new and better products requires foresight to provide the intermediate inputs vital to their production. Third, Soviet producers operate in a chronic sellers' market in which they have little incentive to assume the risks of providing technologically advanced products. Finally, the Soviets are short of specialized facilities, and an experienced management, for the production of custom-made equipment. Custom-made equipment tends to be improvised and handicrafted within special shops of user organizations.[38] Unaware of on-going technological developments, non-specialized producers tend to concentrate on minor improvements in existing technology rather than applying new technology based on the results of current research and development.[39]

Another organizational requirement for the desired type of production response is a high degree of production specialization. Although there are more than 20 machine building ministries, product specialization is not nearly as pervasive as the extent organizational specialization implies, especially in high technology products. Instead of concentrating on high volume production of particular machinery in a narrow range of enterprises, the nominally specialized enterprises permit a pattern in which small shops produce a wide range of proudcts, precluding the use of highly specialized production equipment.[40]

Furthermore, the high degree of precision in modern machinery production has led in advanced market economies to extensive subcontracting, so as to take further advantage of technological specialization. In the Soviet system, with its chronic unreliability of delivery and loose enforcement of contracts, enterprises are understandably reluctant to subcontract.

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[36] D. Palterovich, op. cit., p. 105.

[37] S. A. Kheinman, "Organizational and Structural Factors in Economic Growth," Ekonomika i organizatisiya promyshlennogo proizvodstva, (EKO), May, 1980, p. 7.

[38] V. P. Rassokhin, "Nuzhna chetvertaya sisteme nauchnykh uchrezhdeniya," Ekonomika i organizatsiva promyshlennogo proizvodstva, January, 1980, p. 56.

[39] S. A. Kheinman, "Mashinstroenie: perspektivy i reservy," Ekonomika i organizatsiya promyshlennogo prozivodstva, June, 1974, p. 46.

[40] For example, only 17 percent of hoisting and transportation equipment is produced in plants of the Ministry of Heavy Machine Building, while the rest is produced in 400 plants in 35 ministries and departments. Road building and maintenance equipment is produced in 155 plants of the Ministry of Road Construction and in 400 enterprises of other ministries. There is no specialized production of gear wheels and 65 percent of mounting hardware is produced in small shops of consuming ministries. The degree of specialization in billets production is only 3 percent and in the production of castings 4.5 percent. There are no specialized plants for the production of castings and forgings. By contrast in the United States the specialization ratios for castings production is 70 percent, for forgings 70 percent and for hot stampings 50 percent. (S. A. Kheinman, "Organizational and Structural Factors in Economic Growth," Ekonomika i organizatsiya promyshlennogo prozvodstva, May, 1980, p. 12.)

Kheinman points out that some of the unsatisfied demand for technologically advanced machinery is being filled by a rising volume of imports. During the Eighth Five Year Plan net machinery imports increased by 34 percent, in the Ninth by 260 percent, and in the first three years of the Tenth by 60 percent.[41]

F. TOPICS DISCUSSED BY SUMMARIES

To conserve space the following topics are discussed as summaries of more extended versions which may be found in the fuller study to be subsequently published by the author.

Unfinished construction.—Capital productivity has been reduced by the rising proportion of investment immobilized in unproductive unfinished construction projects.

Capital repairs.—The prolongation of asset lives requires large outlays for capital repairs. These activities are particularly inefficient users of scarce skilled manpower, machine tools, and construction materials and deprive investment of potential inputs, thereby increasing costs.

Statistical bias.—The existence of price inflation in Soviet investment estimates has been posed in Soviet anecdotal references and in the assertions of Western analysts. If correct, such overstatements of investment and capital stock growth mean that my conclusions of slow productivity trends are overstated.

Comparison of my investment time series with production index analogues prepared by the Office of Soviet Analysis, Central Intelligence Agency, which are calculated in constant prices, indicates little or no bias in the construction component and a maximum inflation rate of two percent in the producer durables component of the investment index.[42]

IV. FUTURE TRENDS AND INFLUENCES

For the decade of the 1980s, at least, capital productivity seems destined to continue its downward trend as changing investment priorities, systemic problems, and new exogenous challenges combine to drive fixed investment increasingly toward branches of industry and sectors of the economy with the highest capital-output ratios. The new challenges include environmental protection and restoration costs, industrial health and safety investments, responses to energy constraints, and belated recognition of the need for consumer-oriented investments.

A. STRUCTURAL CHANGE

The impact of structural changes can be measured by the changing composition of investment priorities (Table 12). When these changes are matched with differential capital coefficients (Table

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[41] Ibid., p. 22.

[42] For more extended discussion of the issue see Stanley H. Cohn, "A Comment on Alec Nove, 'A Note on Growth Investment and Price Indexes,' " Soviet Studies, April 1981, pp. 296–299.

13), the trend in investment toward the most capital-intensive sectors and industry branches is apparent.[43]

TABLE 12.—U.S.S.R.: TRENDS IN INVESTMENT PRIORITIES

[Percentage shares of industrial investment]

	1959–65	1966–70	1971–75	1976–79
Branch of industry:				
Ferrous metals	9.3	8.3	7.6	7.1
Coal	7.2	6.1	4.9	4.5
Oil and gas	11.6	12.9	13.8	17.4
Electric power	11.7	11.4	10.1	8.7
Machinery	15.3	18.8	22.4	24.5
Chemicals	9.0	9.2	9.3	9.9
Forest products	5.6	5.8	4.6	3.9
Construction materials	6.3	5.3	5.0	4.2
Light industry	3.6	4.4	4.2	3.7
Food processing	8.7	7.8	6.9	6.1
Percentage shares of total investment:				
Industry	35.9	35.2	35.0	35.3
Agriculture	16.5	17.2	20.1	20.2
Construction	2.7	3.4	3.8	3.9
Rail transportation	3.4	3.7	2.6	2.7
Nonrail transportation and communications	6.4	5.9	8.2	9.2
Trade	11.0	10.4	10.2	9.8
Education, health, and science	6.1	6.0	5.2	5.1
Housing	19.6	17.2	15.3	13.7

Sources: Narodnoe khozyaystvo SSSR for 1965 and 1979.

TABLE 13.—U.S.S.R.: ESTIMATED FULL CAPITAL COEFFICIENTS, 1978

Branch of indutry	Full capital coefficient[1]	Economic sector	Full capital coefficient[1]
Metals	2.9933	Industry	2.3070
Coal	3.1442	Agriculture	2.6854
Oil	3.1792	Construction	2.0154
Gas	1.8954	Transportation and communications	2.8226
Electric power	4.5870	Trade	1.8819
Machinery	2.0149		
Chemicals	2.4565		
Forest products	2.1830	Material product	2.2616
Construction materials	2.7372		
Light industry	1.6529		
Food processing	1.6529		

[1] Rubles of fixed capital per ruble of delivery to final demand.

Source: U.S. Department of Commerce, "The Reconstructed 1972 Soviet Input-Output Tables" (Working Paper–December 1980).

B. ENERGY CONSTRAINTS

In theory, under market conditions, energy contraints would raise the price of energy and lead to premature retirement of energy-inefficient capital. In the short run, inefficient assets would be used less intensively; in the long run, energy-saving capital would be substituted. This effect would increase capital requirements per unit of output, and reduce capital productivity. Under Soviet conditions, however, the impact would be different since Soviet prices do not respond quickly to changing costs. Capital would not be retired but would be used less as energy was rationed.

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[43] The desired capital coefficient is the full, or direct plus indirect, as distinguished from the direct coefficients computed in Table 7. The direct coefficients measure the average capital-output ratio not only for the sector or branch in question, but also reflect the ratios for supplying sectors or branches. In other words, the expansion of output in a given branch requires a certain amount of additional capital not only in that branch but also in supplying branches.

The USSR has belatedly raised energy prices to stimulate the production of more energy-efficient capital. In the wholesale price revision effective at the beginning of 1982, the highest increases were for energy. Prices for coal were raised by 42 percent, and for thermally generated electric heat and power by 70 percent. Oil and gas prices were increased in proportions similar to that for coal.[44] Investment decisions embodied in the Eleventh Five-Year Plan may reflect the planned rise in energy prices, since the plan is valued in revised 1982 prices.

C. RETIREMENT IMPERATIVES

Despite the accelerated depreciation (amortization) rates in effect since 1975, retirements of obsolete assets have continued at sluggish rates and, according to one Soviet economist, have even declined.[45] Indeed, in industry the average retirement rate for all assets fell from 3.0 percent during 1917–75, to 2.7 percent during 1976–78.

Adhering to low retirement rates for existing assets while the growth of fixed investment levels off would lead to a rapidly aging capital stock and undesirable consequences for capital productivity. Assuming investment grows at an average annual rate of 6 percent during the 1980s—an optimistic assumption—the retirement rate for the economy as a whole would have to increase from an actual rate of 1.3 percent during 1976–80 to 2.4 percent just to keep capital stock from aging further. Similarly, within industry, retirement rates for durables would have to increase from 2.2 percent (1978) to 5.8 percent. This example underscores the need for urgent changes in asset retirement rates.

D. REPLACEMENT INVESTMENT

The importance of replacement investment was explicitly recognized in the comprehensive planning decree of July 1979, which gave priority to replacement investment over new construction in the allocation of imports and financing.[46] Further, special bonuses were decreed for fulfillment of goals for reequipping existing enterprises. More recently, replacement investment has been given renewed emphasis in the goals of the Eleventh Five-Year Plan, which at the same time calls for a sharp curtailment in new construction.[47] However, even if the role of replacement investment is strengthened significantly during the 1980s—and past performance casts doubt on this prospect—the effect on capital productivity will hinge crucially on whether new replacement assets are technologically improved over old ones.

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[44] A Komin, "The Task of Improving Wholesale Prices and Rates in Industry," JPRS 76114, p. 31.

[45] D. Palterovich, "Obnovlenie oborudovaniya i tekhnicheskoye perevooruzhovanie proizvodstva," Planovoe khozyaystvo, August 1980, p. 104.

[46] "Raising the Effectiveness of Construction", Stroitel'naya gazeta, August 1979. JPRS 74481, October 30, 1980, "USSR Report—Industrial Affairs."

[47] Nonetheless, the replacement shares of total state investment was planned to be only 15.4 percent in 1982 and 16.4 percent in 1981. Promyshlennoe stroitel'stvo, No. 2, 1980.

E. UNFINISHED CONSTRUCTION

The Eleventh Five-Year Plan calls for reductions in the volume of unfinished contruction but does not disclose any quantitative goals. The task will not be easy. In 1978, Soviet planners hoped to limit the value of unfinished construction to 83 billion rubles; the actual level was 97 billion. Nevertheless, some progress may be achieved during 1981–85. The rate of growth of fixed investment will be less than in the past, allowing for some catching up. In addition, there have been some changes in the existing system of incentives for construction workers. Construction organizations have been generally compensated as stages of a project were completed. Under the new incentive system, payment is supposed to be made only when a project is completed in its entirety and accepted by the customer.[48] This reform is a necessary first step in slowing or reversing the growth in the ratio of unfinished construction to annual new fixed investment.

F. MODERNIZING THE MACHINERY PRODUCTION PROFILE

It should come as no surprise that the Soviets are seeking solutions to their productivity problem through improvements in the system governing production of technologically advanced machinery. Under the comprehensive planning decree of July 1979, five years replaced one year as the fundamental planning unit. This plan for five years is to be coordinated with a 20-year scientific-technical plan, and a 10-year plan that sets forth overall directions of economic and social development. Such coordination, it is hoped, will help planners to avoid current decisions that might lock the economy into directions that are inconsistent with future technological progress. At the same time, however, the planning reform does little to enhance managerial flexibility—underlining a cardinal Soviet premise that managers cannot be trusted to arrive at proper decisions without guidance from central planners.

Some economists, again eschewing incentives, advocate reorganization of machinery production into ministries organized more narrowly by function. Supra-ministries agencies would administer groups of machinery production.[49] Such proposals would disrupt traditional patterns of industrial activity as well as threaten vested interests and are unlikely to come to pass. Thus, from the standpoint of planning and organization, little real progress may be expected toward a solution to the central problem of slowing the decline in capital productivity through more rapid advances in the technological quality of Soviet machinery and processes.

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[48] T. Khachaturov, "Puti povysheniya effektivnosti kapital'nykh vlozhenii," Voprosy ekonomiki, July 1979, p. 129.

[49] Paul Cocks, "Rethinking the Organizational Weapon: The Soviet System in a Systems Age", World Politics, January 1980.

G. FACTOR PROPORTIONS

Through 1985 at least, growth in capital stock will outstrip growth in employment by a wide margin, resulting in the addition of significant increments of capital that Soviet industry in particular, and the Soviet economy in general, will have to strain to assimilate. The able-bodied population in the USSR will increase during the next few years at an average estimated annual rate of about one-half percent per year.[50] It is further estimated that capital stock will grow at about 5 percent a year,[51] or higher if the Soviets fail to meet planned asset retirement rates, or if progress is made in bringing unfinished construction on stream faster. These relative growth rates imply a compounded rate of growth in the capital-employment (manhour) ratio of about *10 percent* a year through 1985—an historically unprecedented rate. The negative impact that this shift in factor proportions will have on capital productivity is likely to be offset only by a combination of favorable developments.

Relatively more capital goes to the mechanization of auxiliary production.

The ratio of replacement investment to new construction is increased.

New producer durables are technologically more advanced, and more productive, than assets being replaced.

Demographic trends are offset by the release to productive uses of labor now held in reserve by employers by peak period production.

H. SOCIALLY ORIENTED INVESTMENT

Like all industrialized countries, the USSR must devote some resources to the protection of the environment, industrial health and safety, and other social purposes. While the long-run effect of this type of investment may be to improve morale and productivity, in the short-run the payoffs in improving the productivity of capital are meager.[52]

Investment for environmental improvements in the USSR is significant. In the Tenth Five-year Plan, for example, about 5 percent of total investment capital (24–33 billion rubles) was allocated to the environment;[53] this compares with 4.7 percent for the United States. On the basis of available data, however, only about 18 percent of the planned Soviet investment in the environment can be accounted for. About 15 percent (less than one percent of total investment) was allocated to energy, as follows: electric power—7 percent; coal—4 percent; and oil and gas—4 percent.[54] In addition, about 3 percent (less than two-tenths of one percent of total investment) was allocated to the metallurgical sector.[55]

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[50] Steven Rapawy, "Estimates and Projections of the Labor Force and Civilian Employment in the USSR, 1950 to 1990," (Foreign Economic Report No. 10), Table 1.

[51] This rate is based upon the Eleventh Five Year Plan investment growth rate of 2.6 percent per year and upon continuation of the Tenth Five-Year Plan retirement rate of 2.4 percent.

[52] A broader concept of national welfare than the traditional "new material product" could be formulated to take account of the benefits of social investments. For proposals of Soviet economists see M. Vilenski and V. Fel'zenbaum, "The Social and Economic Effectiveness of New Technology," Problems of Economics, April 1980. In official Soviet circles, there is practically no concern with cost-benefit analysis of environmental-type investment. See T. S. Khachaturov, "Ekonomicheskii voprosy ekologii," Vestinik akademiya nauk SSSR, February 1980, p. 51.

[53] D. M. Palterovich, "Peculiarities of the Development of the Tools of Labor During the Period of the Scientific and Technical Revolution," Izvestiya akademiya nauk SSSR—Seriya ekonomcheskaya, July–August 1979, p. 33. (JPRS 74282, October 1, 1980. "USSR Report—Economic Affairs," No. 892.)

From the standpoint of the industries receiving investment allocation, the proportion of resources dedicated to environmental uses can seem quite large. For example, environmental investment represents 12 percent of the resources allocated to the electric power industry, 13 percent for coal, and 14 percent for oil and gas. The corresponding shares for ferrous metals, however, where the environmental impact tends to be relatively high, is only about 5 percent. For energy sectors especially, since they are highly capital-intensive, the impact of environmental investment on capital productivity may be assumed to be relatively greater than for industry or the economy as a whole.

Investments for health and safety also are becoming a growing and significant share of capital investment in some sectors. In light industry, for example, the share is about 8 percent. Moreover, investment for health and safety has risen from 5 percent of the cost of buildings and structures in light industry in 1971 to about 25 percent, currently. In selected enterprises of other branches of industry, investment for health and safety has reached one-third of the cost of fixed capital, and in some cases as much as 40 to 50 percent. These proportions are quite high, and probably atypical.

The impact of investment for environmental purposes and for health and safety on capital productivity has probably been fairly small. If we assume that over the past ten years, these types of investment represented on the average about 4 percent of total investment, it may be calculated that capital productivity declined by about 15 percent more than it would have in the absence of such investments.[56] In the 1980s, however, the relative importance and influence of environmental investment is likely to rise.

I. CONSUMER-ORIENTED INVESTMENT

Capital productivity in the USSR would probably have declined at an even faster rate if, over the years, a greater share of investment had been channeled into such consumer oriented sectors, as housing and highways, which are extremely capital-intensive. The capital coefficient for housing in 1972 was 8.24—or about ten times larger than that of industry (0.73) and net material product (0.88). Based on analogous data for the United States, the capital coefficient for highways in the USSR is probably similar to that of housing and highways.

In the short-run, consumer oriented investment probably would reduce capital productivity by adding more to capital than to output. The long-run effect might be the opposite, adding relatively more to output than to capital through improved morale—and hence a stronger work ethic—from altered expectations for a higher standard of living.

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[54] V. Falts'man, I. Zasorina, "Fondootdacha i kapitaloemkost' toplivo-energetichekogo kompleksa," Voprosy ekonomiki, March 1979, p. 32.

[55] V. Falts'man, V. Borisov, "Statistical Analysis of the Impact of Technology on the Output-Capital Ratio and Capital-Intensiveness of Investment Sectors," Ekonomika i matematicheskiye metody, March-April 1980, p. 56, (JPRS 75873, June 13, 1980, "USSR Report—Economic Affairs," No. 928.)

[56] The consequent higher rate of growth of capital stock with no change in measured output would yield this productivity result.

SLUGGISH SOVIET STEEL INDUSTRY HOLDS DOWN ECONOMIC GROWTH* **

CONTENTS

Page
Key judgments 195
Introduction 197
Background 197
    Historical development 197
    Production peaks in late 1970s 199
    Turnaround in Soviet trade 200
What went wrong? 200
    Planning errors 200
    Transportation bottlenecks 202
    Raw materials squeeze 202
        Iron ore production stagnates 202
        Falling production of coking coal 205
        Scrap metal 206
Outlook 207
    Production 207
    Raw materials shortages and modernization 211
    Imports as a safety valve 213
Annex 214

TABLES

1. Soviet, U.S., and Japanese production of crude steel 198
2. Planned and actual steel production, 1980 199
3. Production of steel and related products 199
4. Iron ore deposits by region 203
5. Iron ore production by region 203
6. Production of coking coal by basin 205
7. Actual and planned production of steel and related products, 1981–85 208
8. Real capital investment per ton of additional iron and steel capacity 210
9. Pig iron and scrap metal requirements by type of steelmaking furnace 211
10. Steelmaking capacity by type of furnace in the USSR, United States and Japan 213

Sluggish Soviet Steel Industry Holds Down Economic Growth(U) Key Judgments

The Soviet steel industry has become a major drag on the economy. Shortages of steel, expecially high-quality products, are holding back the growth of civilian economy. Planned cutbacks in the growth of new fixed investment stem in large part from the lack of steel to support construction and the manufacture of producer durables.

The 1981–85 Plan calls for production of crude steel and rolled steel products to increase to 169 million metric tons and 118 million tons, respectively, by 1985—roughly the same level originally planned for 1980. These goals are beyond reach; we estimate that output of crude steel will be about 155 million tons in 1985 and rolled steel output about 108 million tons.

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*This article was written by analysts in the Central Intelligence Agency.

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During the early 1980s at least, lagging steel production could well be the most important bottleneck undercutting Soviet plans to provide steady increases in the production of military hardware while satisfying the demand for consumer durables and investment goods and maintaining exports, primarily to Eastern Europe. Shortfalls in steel production are likely to limit investment in key sectors of the economy such as electric power, transportation, and nonferrous metallurgy.

To fill part of the gap between the supply of and demand for steel products in the USSR, Moscow has turned to Western suppliers. Net steel imports (including pipe) from the West now rank near the top of the Soviet import bill. Purchases of steel will have to continue well into the 1980s, aggravating the USSR's prospective hard currency bind.

The main cause of the deteriorating performance of the steel industry is inadequate past investment in all sectors of the industry—from mining to rolling and finishing steel products. Investment allocations have not been enough to support ambitious development plans, partly because real investment costs have been rising and allocations do not stretch as far as before. Although the USSR plans to increase investment in the steel industry by almost one-third in 1981–85 compared with 1976–80, the plan probably understates the amount of new investment required to achieve the necessary capacity growth. In particular, the imbalances in capacity among the components of the industry—iron ore, coking coal, crude steel, and finished steel are unlikely to be eliminated over the next several years because of the long gestation periods involved in bringing new capacity on line.

In addition, shortfalls in the production of coking coal and iron ore and in the collection of scrap metal have pulled steel production down. Raw materials for the steel industry are likely to continue to be tight. As a result, the USSR would have to either trim plans for steel production, cut exports, boost imports, or adopt some combination of these options. All of these choices are unpalatable. Shaving production plans would aggravate the steel shortages already plaguing many sectors of the economy. Cutting exports would weaken client states in Eastern Europe. Boosting raw material imports to the level needed to support planned 1985 steel production would cost at least $2 billion annually at current market prices—this on top of the large amounts the Soviets will have to spend for Western steel products.

Raw materials shortages also will interfere with plans to modernize steelmaking capacity, thus depriving the USSR of potential savings of raw materials, energy, and labor. A longstanding Soviet objective is to replace a large share of older open-hearth furnaces with the basic oxygen furnaces and electric furnaces predominant in the rest of the world. However, the unpredictability of raw material supplies will force the Soviets to keep the open-hearth furnaces, in which pig iron and scrap metal are completely substitutable.

Large purchases of steel products and Western processing technology will be needed through most of the 1980s at least. Imports of large-diameter pipe figure heavily in Soviet plans for the construction of oil and gas pipelines—including the proposed Siberia-to-Europe line. Until at least the mid-1980s, the Soviets also will need to buy large amounts of cold-rolled steel for machine building, automobiles, and consumer durables, tin plate for canning and packaging, and various types of sheet products for use in transformers and electric motors.

The USSR is also seeking Western processing technology to reduce its dependence on imports of Western specialty steel and as part of an overall modernization program. The French are building an important steel plant at Novolipetsk which will produce 7 million tons of specialty steels per year when full capacity is achieved (1986 at the earliest). The West Germans are building a large steel plant at Stary Oskol near Kursk with an announced annual capacity of about 4 million tons. This plant, scheduled for completion in the mid-1980s, will use a technology that does not rely on blast furnaces and therefore uses much less coke. Both Novolipetsk and Kursk are critical to Soviet steel development especially to production of specialty steels.

INTRODUCTION

Steel production problems have gained a great deal of attention in the internal debate over Soviet economic policies and have signficance for both economic growth and the Soviet balance of payments. An article in Sotsialisticheskaya industriya zeroed in on steel's dismal performance in the first two months of 1982.

> The situation in the USSR of ferrous metalurgy has not changed for the better. The metallurgists failed to fulfill the 2-month plan in terms of pig iron, steel, finished rolled metal products and coke. Production of these most important types of output was 4 to 5 percent lower than it was in the same months last year. A shortage of metal is now being felt in all machine-building sectors and in construction, and this is affecting the rhythm and coordination of the work of the entire national economy.[1]

This report (a) assesses the causes of the current lag in production, giving special attention to problems in the production of iron ore, coking coal, and scrap metal, (b) discusses the impact of raw materials supply on Soviet efforts to modernize steelmaking capacity, and (c) examines some of the adjustments that Moscow has made and will have to make during the 1980s to cope with steel shortages.

BACKGROUND

HISTORICAL DEVELOPMENT

By any yardstick, the Soviet iron and steel industry is huge. Crude steel output was 149 million tons in 1981—roughly one-fifth of total world production and some 40 and 50 million tons more than output in the United States and Japan, respectively (see table 1).[2] The USSR is the world's largest producer of rolled steel products, steel pipe, coking coal, iron ore, pig iron, and manganese.[3] It has about 40 percent of the world's proven reserves of iron ore and manganese and about 20 percent of the world's reserves of coal, much of which is suitable for coking. In 1980, the Soviet iron and steel industry:

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[1] Sotsialisticheskaya Industriya, 16 March 1982.

[2] Crude steel is the product in the first solid state after melting. All data on steel production refer to crude steel, unless otherwise indicated.

Accounted for about 6 percent of the total value of industrial output and about 9 percent of the value of industrial capital stock.

Employed about 1.4 million workers—about 4 percent of the industrial labor force and more than triple the number of iron and steelworkers in the United States.

Consumed about 10 percent of the Soviet output of electric power and natural gas and about 25 percent of the country's production of coal.[4]

TABLE 1.—SOVIET, UNITED STATES AND JAPANESE PRODUCTION OF CRUDE STEEL

[Million metric tons]

	USSR	United States	Japan
1950	27.3	87.8	4.8
1960	65.3	90.1	22.1
1965	91.0	119.3	41.2
1970	115.9	119.3	93.3
1975	141.3	105.8	102.3
1980	147.9	101.5	111.4
1981	149.0	108.9	101.7

Source: Data for the USSR are taken from annual issues of Narodnoye khozyaystvo SSSR. Data for the United States and Japan are taken from various issues of the "Annual Statistical Report," American Iron and Steel Institute. Data for 1981 are preliminary.

During the same period, the Soviet ferrous metal sectors included:

130 iron ore mines with a total estimated capacity of 500 million tons of crude ore.[5]

92 beneficiating plants to concentrate iron ore for shipment to blast furnaces.

36 enterprises (with 138 blast furnaces) to produce pig iron, including the world's largest blast furnace at Krivoy Rog.

76 steel mills, including the huge plants at Magnitogorsk and Krivoy Rog, whose total output exceeds the combined steel production of Italy and France (see figure 1).

With the backing of a leadership determined to ensure that there would be enough steel to support a broad range of ambitious military and industrial programs, steel production grew without interruption during 1950–75. The annual increments were steady, averaging about 4 million tons in the 1950's and about 5 million tons from 1960 through 1975. In 1971 the USSR achieved its longstanding goal of surpassing the United States in steel production and becoming the world's largest producer.

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[3] Pig iron is produced in blast furnaces, using coking coal, iron ore, and limestone. Coking coal is the chemical agent to reduce the iron ore. Manganese is an additive used in any type of steel production to remove oxygen from the molten steel.

[4] N.P. Bannyy, et al, Ekonomika chernoy metallurgii, Moscow, 1978, p. 5.; K.I. Zhilyayav, et al, Ekonomiya material 'nykh resursov chernoy metallurgii, Moscow: 1979, P. 5., and Gazovaya promyshlenmost, June 1978, p. 10.

[5] Usable iron ore is raw ore that has been cleaned. Raw ore is the product first extracted from the mine. It includes rock, dirt, and other debris.

PRODUCTION PEAKS IN LATE 1970S

During 1976–80, the Soviet steel industry continued to develop, adding about 134 million tons of raw iron ore capacity, mainly in the Ukraine and Kursk; 5.6 million tons of pig iron capacity; 14.3 million tons of crude steel capacity; and 7.4 million tons of rolled steel capacity (all calculated in terms of potential annual production). Total investment in the iron and steel industry amounted to about 15 billion rubles—6 percent of total Soviet industrial investment and about 25 percent more than allocations to the steel industry during 1971–75.

Despite the capacity buildup, steel production faltered during 1976–80 as all sectors of the iron and steel industry fell considerably short of the original targets for 1980 (see table 2).

TABLE 2.—PLANNED AND ACTUAL STEEL PRODUCTION, 1980

[Million metric tons]

	Planned	Actual	Shortfall (percent)
Iron ore	275	245	11
Coking coal	205	178	13
Pig iron	122	107	12
Crude steel	168.5	148	12
Rolled steel	117.5	103	13
Steel pipe	19.8	18.1	9

Source: Data on planned steel production based on Pravda, October 28, 1976.

Production of crude steel climbed from about 141 million tons in 1975 to a peak of about 152 million tons in 1978. Following a downturn in 1979 and 1980, output registered a slight improvemnet last year (see table 3). In 1980, steel production fell about 20.5 million tons short of plan. The cumulative gain in production achieved during 1976–80—less than 7 million tons—was not substantially greater than annual gains posted during 1960–75. Output of rolled steel products, pig iron, coking coal, and iron ore also has stagnated or declined since 1978.

TABLE 3.—PRODUCTION OF STEEL AND RELATED PRODUCTS [1]

[Million metric tons]

	1975	1976	1977	1978	1979	1980	1981 [2]	1985	
								Plan [3]	Estimated
Crude steel	141.3	144.8	146.7	151.5	149.1	147.9	149.0	169.0	155
Rolled steel products	98.7	101.4	102.1	105.4	103.2	102.9	103.0	118.0	108
Steel pipe	16.0	16.8	17.0	17.5	18.2	18.2	18.5	21.9	21
Iron ore	234.9	241.2	242.0	246.4	241.7	244.7			243
275 [5] (255)									
Pig iron	103.0	105.4	107.4	110.7	109.0	107.3	107.0	118.0	([6])
Coking coal [4]	181.0	186.2	186.3	182.0	181.0	178.0	175.0	193.0	170

[1] All data taken from Narodnoye khozyaistvo SSSR v godu, unless otherwise indicated.

[2] Preliminary.

[3] Data for rolled steel products based on official Soviet plans. Data for all other products based on recent statements by I. Kazanets, Minister of Ferrous Metals, and "Summary of World Broadcasts," SU/W1164/A/10, Dec. 11, 1981.

[4] Data for 1975–78 are taken from the No. 4 issue of Ugol' (the Soviet coal journal). Data for 1979–81 are estimated.

[5] The Soviets recently reduced the 1985 goal for iron ore production to 262.4 million tons. See Gorniy Zhurnal, No. 3, 1982, for details.

[6] Not available.

There is little prospect for a near-term recovery. Indeed, performance in all sectors of the steel industry was lackluster at best in 1981. Production of crude steel rose slightly to 149 million tons, about 8 million tons below the 1981 plan.[6] Output of rolled steel products held at 103 million tons, about the same level achieved in 1977 and 6 million tons short of the 1981 target. Production of iron ore and coking coal leveled off or declined. Output of coking coal dropped to an estimated 175 million tons, about 6 percent below the 1977 peak.

TURNAROUND IN SOVIET TRADE

The shortfalls in domestic steel production have led Soviet planners to increase markedly their imports from the West of both steel products and Western steelmaking equipment and technology. In 1970 the USSR was a net exporter of steel, but by the late 1970s imports and exports were roughly in balance—about 7 million tons on each side.[7] Buying expensive steel from the West and selling less expensive types to other Communist countries and the LDCs, however, caused the USSR's annual net steel hard currency import bill to rise substantially. Steel now ranks near the top of the Soviet import bill.

To compensate for domestic shortcomings, primarily in the production of rolled steel products, Moscow has sought Western steelmaking equipment and technology. Since 1975, the Soviets have purchased substantial amounts of technology primarily from West Germany, France, Italy, and Japan. A large share of Soviet expenditures since 1975 have been earmarked for the huge Novolipetsk specialty steel plant, being built by the French, and the large steel plant near Kursk, being built with West German assistance.

WHAT WENT WRONG?

PLANNING ERRORS

Soviet publications advance a number of reasons for the poor performance of the steel industry and the resulting shortages of steel products throughout the economy. A major problem has been the industry's inability to provide a broader assortment of high-quality steel products. This situation did not occur suddenly; it has been emerging for the last 20 years and stems directly from the consistent priority that the USSR has given crude steel production. Despite rhetoric to the contrary, little priority has been accorded to improving the quality of steel products and modernizing steelmaking capacity. Thus the Soviets are paying the price for unbalanced investment decisions made at least a decade ago.

Despite the urgent advice of Soviet specialists, progress in reorienting investment priorities has been slow. According to a Soviet analysis, about 90 percent of annual investment in the steel industry in the late 1970s was earmarked for facilities to boost crude steel production.[8] Other studies indicate that if investment priorities were changed in favor of qualitative improvement and modernization, demand for steel products could be met for the foreseeable future with no increase in crude steel production or total capital investment.[9] While these claims clearly are exaggerated, the industry clearly would benefit greatly from greater steelmaking efficiency.

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[6] The 1981 plan set the following targets: crude steel, 156.8 million tons; rolled steel products, 109 million tons; and iron ore, 252 million tons. See Kommunist vooruzhennikh sil, No. 15, 1981, pp. 18–23.

[7] The Soviets suspended reporting on steel trade in 1976. Thus, judgments on the volume of steel trade since 1976 must be considered rough approximations, subject to a range of error of at least 1 million tons on both the import and export side.

A basic measure of the efficiency of steelmaking operations is the yield obtained in the production of rolled steel products.[10] A longstanding Soviet objective has been to improve the yield in steelmaking operations to at least the level achieved in the United States. In 1981 the Soviet yield was 69 percent, a ratio that hasn't changed much since 1950. The yield in the United States and Japan was about 74 percent and 87 percent, respectively, in 1981. In other words, the Soviets had to produce about 1.45 tons of crude steel to obtain 1 ton of rolled product in 1981, compared with about 1.35 tons in the United States and 1.15 tons in Japan.

The Soviets seem to be counting on a sharp increase in continuously cast steel to increase the yield in steelmaking operations. According to a Soviet calculation, continuous casting increases the yield by about 12 percent while allowing for substantial savings in energy in labor. Soviet plans call for continuously cast steel to increase from about 16 million tons in 1980 to about 36 million tons by 1985, an outcome we consider unrealistic. To achieve this plan, the Soviets would need to install as much continuous casting capacity during 1981–85 as had been installed during 1966–80. Even if the Soviets carried out this plan, continuously cast steel would only account for about 20 percent of planned steel production in 1985. In Japan and Western Europe, continuous casting presently accounts for over half of annual steel production.

If the Soviets could increase the yield in steelmaking, they would realize substantial benefits—an increased availability of steel products and a reduction in iron ore, coking coal, and scrap metal requirements. For example, at the 1981 level of production, every percentage point of increase in the yield would result in about 1.5 million tons of additional rolled steel products. Looked at in a different way, if the yield did not increase, an additional 1.5 million tons of rolled steel products could only be obtained by producing an additional 2.2 million tons of crude steel.

Rhetoric aside, Moscow seems not to be counting on an improvement in yield to ease steel shortages, at least during the current plan. Soviet plans call for crude steel production to increase to 169 million tons by 1985 and rolled steel output to 118 million tons in that year—for an implied yield of about 70 percent.

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[8] N. F. Sklokin, Ekonomicheskiye problemy povysheniya kachestva i razvitiva sortamenta chernykh metallov, Moscow: 1979, p. 6.

[9] Kommunist, No. 13, 1979, p. 17.

[10] The yield is the ratio of production of rolled steel to production of crude steel. The yield is determined in part by the composition of the steel product mix. Because a large share of Soviet steel output consists of relatively simple types of products and castings, their yield may never equal that of the US or Japan.

TRANSPORTATION BOTTLENECKS

The ferrous metals industry also has been hurt by increasing transportation delays—especially in the rail transport system. Transportation snarls are especially troublesome because Soviet steel plants typically operate with low inventories of iron ore and coking coal. Consequently, even small supply disruptions can limit Soviet steelmaking operations. There also have been reports that spot shortages of fuel and brownouts caused by electric power interruptions (the latter caused by transportation foul-ups) have curbed steel production, mainly in the western USSR. On balance, however, shortages of fuel or electric power probably have not been a primary cause of the shortfalls in Soviet steel production.

Because of transportation delays it is becoming difficult for the Soviets to deliver iron ore to the blast furnaces. The volume and the distance of iron ore shipments have increased greatly, straining an already overtaxed rail transport system. The production deficit in the Urals is especially troublesome for Soviet planners. Iron ore mined in the Urals presently accounts for only half of the region's requirements. For example, about one-third of the annual output of the Kursk Magnetic Anomaly (some 13 million tons) must be shipped to blast furnaces in the Urals, a distance of over 1,000 kilometers. Additional amounts of ore must be shipped to the Urals from the Kola Peninsula, the Ukraine, and Kazakhstan (deliveries of coking coal pose analogous problems, as discussed below). West Siberia also has become more dependent on ore from other regions to meet its requirements. About 3 million tons of ore must be shipped to Novokuznetsk from Rudnyy in Kazakhstan (see figure 2). Because no major expansion is slated in iron ore production in either Siberia or Kazakhstan, the Soviets may have to tap ore producers in the Western USSR to provide Siberian blast furnaces with adequate amounts of iron ore.[11]

RAW MATERIALS SQUEEZE

During the 1970s, imbalances between steel production and the supply of essential raw materials for steelmaking, which have their origin partly in planning errors and transportation bottlenecks, were the decisive, immediate constraint on the growth of the Soviet steel industry. Problems in providing sufficient iron ore, coking coal, and scrap metal have been building for years and are likely to limit gains in Soviet steel production well into the 1980s.

Iron ore.—The Soviets estimate that their reserves of iron ore are about 60 billion tons—40 percent of the world's total and enough to support the current level of ore production for well over two centuries (see figure 3). About two-thirds of the iron ore reserves are located in the Western USSR—mainly at Krivoy Rog and the Kursk Magnetic Anomaly (see table 5). Moreover, about 70 percent of the country's iron ore deposits can be exploited by inexpensive open-pit mining methods.[12] Depending on a variety of circumstances, production costs at open-pit mines can be as little as one-fourth of the cost of underground operations.

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[11] See "Soviet Geography: Review and Translation," April 1979, p. 270.

[12] G. A. Braun, Zhelezorudnaya baza chernoy metallurgii USSR, Moscow, 1970, p. 5.

TABLE 4.—IRON ORE DEPOSITS BY REGION

	Billion metric tons	Percentage share
Total	63.7	100
Western U.S.S.R.	41.2	65
Kursk-Magnetic Anomaly	16.7	
Krivoy-Rog	15.9	
Other	8.6	
Urals	6.1	9
Eastern U.S.S.R.	16.4	26
Siberia	4.9	
Far East	1.7	
Kazakhstan	7.6	
Other	2.2	

Source: P. A. Shiryayev, "Metallurgicheskaya i ekonomicheskaya otsenka zhelezorudnoi bazy SSSR," Moscow, 1978, p. 9. See also V. A. Boyarskiy, "Razvitiye otkrytoy dobychi rud," Moscow: 1975, pp. 28–32.

During 1976–80, however, the iron ore sector turned in its worst performance since World War II. Output of usable iron ore amounted to 245 million tons in 1980, 10 million tons more than production in 1975, but 30 million tons below plan. Annual increments in production during 1976–80—2.0 million tons—were only about one-third of the average annual gain registered routinely during 1950–75. Production dropped 243 million tons in 1982, 2 million tons less than a year earlier, and about 9 million tons below the 1982 target. Production of iron ore has leveled off in the Urals, Krivoy Rog, and the Kursk Magnetic Anomaly—basins that account for about 80 percent of total Soviet iron ore production (see table 5).

TABLE 5.—IRON ORE PRODUCTION BY REGION [1]

[Million metric tons, usable ore]

	1970 [2]	1975 [2]	1976 [3]	1977 [3]	1978 [3]	1979 [3]	1980 [4]
Total	196	233	239	240	244	241	245
RSFSR	66	89	91	91	93	89	92
Eastern U.S.S.R.	25	45	47	47	49	49	50
Kola Peninslua	8	10	10	9	10	9	11
Kursk magnetic anomaly	18	36	37	38	40	40	39
Urals	26	26	27	27	27	27	25
Siberia	13	16	16	15	15	14	17
Kazakhstan	18	21	22	23	25	24	[4] 26
Ukraine (mainly Krivoy Rog)	111	123	127	126	127	126	[4] 126

[1] Because of rounding, components may not add to the totals shown.
[2] "Soviet Geography: Review and Translation," April 1979, p. 269.
[3] Data for total production taken from Narodnoye khozyaystvo SSSR. Regional breakdown interpolated.
[4] Soviet Geography: Review and Translation, No. 4, 1982 and SSSR i soyuzniye respubliki v 1980 Godu, Moscow: 1981.

The stagnation in iron ore production apparently caught Soviet planners by surprise. As recently as 1977, there were press articles where Soviet officials confidently predicted that production would easily reach 275 million tons by 1930 and 350 million tons by mid-1980s.[13] They overlooked two unfavorable trends of long standing:

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[12] Depletion is defined here as the amount of capacity lost because of mine exhaustion and the lower productivity of older mines that are still operating.

Annual additions of new mining capacity have been increasingly offset by rising mine depletion in older basins.[14]

Declining ore grades have resulted in a sharp increase in production costs as well as a growing share of investment that must be devoted to building new ore-enriching facilities.

These trends cannot be reversed quickly or cheaply.

Gross annual additions of new iron ore capacity amounted to about 8 million tons of usable ore during 1976–80, about the same amount achieved yearly since the mid-1960s. At the same time, mine depletions rose to about 6 million tons per year during 1976–80, compared with about 3 million tons a decade earlier. The Soviet data suggest that about three-fourths of annual gross additions of new capacity now simply offset mine depletion.

The Soviets are plagued by increasing delays between the announced start up of new mines and the time those mines reach full capacity. These delays are caused by a failure to appreciate the increasing poor quality of the iron ore, the greater depths that must be mined and increasing investment in ore-enrichment facilities. In 1976 the Soviets announced the start-up of new mines at Krivoy Rog and the Kursk Magnetic Anomaly with a combined annual capacity of 12 million tons. By 1979, these mines were producing anually only 4.5 million tons of crude ore.[15] The Kostomuksha deposit in Karelia originally was scheduled to reach full capacity of 24 million tons of crude ore per year by the mid-1970s. The Soviets now claim that the first stage of the mine will begin operations in 1982 but that the deposit will not be fully operational in 1985.

Meanwhile the average ferrous content of working deposits declined from 50 percent in 1950 to 44 percent in 1970 and 35 percent in 1980.[16] Almost nine-tenths of Soviet iron ore must now be enriched compared with only one-third in the late 1950s.[17] Because of the steady fall in ore quality, the Soviets have had to divert increasing amounts of investment to building beneficiating facilities, raising both costs and labor requirements. Investment in ore beneficiation jumped from about 2 billion rubles during 1970–75 to more than 3 billion rubles during 1976–80.[18] About 70 percent of investment in the iron ore sector currently is going into these facilities, compared with about 40 percent in the late 1960s.[19] There are fewer rubles left for construction of new mines and modernization of older facilities.

The increase in the volume of raw ore that must be processed to obtain a ton of usable ore has resulted in a large rise in real investment costs—to about 102 rubles per ton of usable ore in the late 1970s compared with 61 rubles per ton a decade earlier (see table 8 for details).[20] According to a Soviet estimate the average grade of iron ore will drop by 10 to 15 percent during the 1980s, pushing up costs and investment requirements even more.[21]

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[14] See, for example, Gornyy Zhurnal, No. 11, 1977.

[15] See, for example, Pravada, 2 April 1979 and Pravada, 29 October 1979.

[16] Politicheskoye samoobrazovaniye, No. 4, 1981, p. 13 and Gornyy zhurnal, No. 1, 1981, pp. 3–7.

[17] K.I. Zhilyaev. op. cit, p. 72.

[18] Gornyy zhurnal, No. 1, 1979, pp. 1–3, and Gorniy zhurnal, No. 1 1981, pp 1–5.

[19] Ibid.

[20] Planovoye khozyaystvo, No. 7, July 1981, pp 31–33.

[21] Planovoye khozyaystvo, No. 12, December 1981, p. 28.

To meet the original 1985 target for usable iron ore (275 million tons), production would have to increase by about 8 million tons per year during the remainder of the current plan, roughly three times the average annual increase achieved during 1976–80. Because of the long lead times involved between the decision to build a new mine and bringing the mine up to full-capacity operation (seven to 12 years) the Soviets would have to accelerate the completion of new capacity to reach projected 1985 output. Even if the depletion rate does not increase, gross capacity of about 60 million tons would have to be put on line during the current plan (1981–85)—12 million tons per year—to achieve the 1985 target. The USSR never has been able to commission this much capacity in any plan period. Gross annual commissionings averaged about 8 million tons per year during 1976–80, fell to about 6 millions tons in 1980, and probably did not exceed 4 million tons in 1981.

Soviet calculations, moreover, indicate that 60 million tons of additional iron ore capacity would require, at a minimum, a capital investment of about 6 billion rubles, which is equivalent to 30 percent of cumulative investment the Minister of Ferrous Metals said was earmarked for the whole ferrous metals sector during 1981–85.[22] (This estimate does not include planned investment for ore beneficiating plants.) The Soviets cannot afford to devote such a large portion of investment to iron ore mining, given competing demands from other sectors of the steel industry.

Falling production of coking coal.—Soviet reserves of coking coal, like the ore reserves, are enormous—65 to 70 billion tons, an amount sufficient to support the current volume of production for well over three centuries.[23] The bulk of Soviet coking coal deposits are located in heavily industrialized regions of the Donets and Kuznetsk basins close to major blast furnaces.[24]

Nonetheless, during 1976–80 the Soviet coal industry turned in its worst performance in the postwar era. Coking coal production slipped from a peak of 186 million tons in 1977 to 175 million tons in 1981 (see table 6). Production is stagnant or in decline at the Donets and Kuznetsk basins, which account for nearly three-fourths of Soviet coking coal production.

TABLE 6.—PRODUCTION OF COKING COAL BY BASIN [1]

[Million metric tons]

	1970	1975	1976	1977	1978	1979 [3]	1980 [3]	1985 [3]	1990 [3]
Total [2]	164.8	181.0	186.2	186.3	182	181	178	170	168
Donets	84.3	88.5	88.1	86.8	82	80	74	67	68
Kuznetsk	46.9	56.1	59.4	59.9	60	60	55	53	53
Karaganda	16.9	18.1	18.9	19.0	19	19	27	26	23
Pechora	12.1	14.1	16.0	16.7	17	18	18	19	19
Other	4.6	4.0	3.8	3.9	4	4	4	5	5

[1] 1970, 1975–78 data are from No. 4 issues of Ugol', 1968–78. Because of rounding, components may not sum to the total shown.

[2] Does not include output at Neryungri in the South Yakutskian coal basin. Coking coal production is scheduled to increase to 6 million tons by 1985 and 13 million tons by 1990. All of the output will be exported to Japan under a long-term contract and thus have no effect on domestic supply.

[3] Estimated.

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[22] Calculated on the basis of a real investment cost of 102 rubles per ton of usable ore. Many of these projects have long lead times; therefore some of the investment that will result in increased capacity during the current plan was allocated during 1976–80. By the same token, some investment during 1981–1985 will not result in new capacity until interplan periods.

[23] I.I. Novitskiy, "Energoticheskoye toplivo SSSR," Moscow: 1979, pp. 10–14. See also V.A. Shelest, "Regional' nyye energoekonomicheskiye problemy SSSR," Moscow: 1978, pp. 113–116.

[24] A major use of coking coal is to reduce chemically iron ore in blast furnaces. The Soviets use about half a ton of coking coal per ton of pig-iron.

Two developments, similar to those in the iron ore sector, are hampering coking coal production:

Mining conditions are deteriorating rapidly, especially in the Donets and Kuznetsk basins.

Because of insufficient past investment, large amounts of new capacity are not coming on stream fast enough to offset stagnant or declining production elsewhere.

In the Donets basin, which currently accounts for about 40 percent of total Soviet coking coal production, mining conditions are among the worst in the world. In terms of mine depth, thinness of the coal seams, and methane concentrations, most of the Donets mines would not belong in the category of proven reserves by Western standards. Production of coking coal in the Donets basin fell from 88 million tons in 1976 to 74 million tons in 1980. This decline will continue well into the 1980s and production will drop below 70 million tons by the end of the decade. At best, the Soviets may be able to stabilize coking coal production in other basins.

Falling production in the Donets basin and reduced imports from Poland have hampered production of pig iron and crude steel, especially in the Ukraine where steel production declined by about 6 percent during 1978–80.

The present problems in the coal industry stem from years of insufficient investment allocations. Since the mid-1960s the coal industry has taken a back seat to oil and gas in investment priority. During the last 20 years, investment in oil and gas has increased by about 300 percent and 400 percent, respectively, in investment in the coal industry by only 50 percent. The coal industry's relatively low priority seems likely to continue during the 1980s. Most of the investment in energy during 1981–85 will be devoted to oil and gas, while a large portion of the remainder will go to support Moscow's ambitious nuclear power program. As a result, coal's share of investment in energy will continue to decline.

Because of lagging investment in the coal industry, the introduction of new capacity has slowed. We estimate that about 80 percent of gross annual commissionings in the coal industry simply offsets depletion, compared with about 50 percent a decade ago.[25]

Scrap metal.—About half of the steel produced in the USSR is smelted from scrap metal, a share that hasn't changed much in the last decade.[26] According to a Soviet calculation the cost of producing steel from scrap is about one-fifth that of producing steel from pig iron.[27] Investment per ton of scrap-based steel is claimed to be dramatically less than the investment needed to smelt steel from pig iron,[28] while transport costs to move scrap metal are reported to be far less than the cost of moving iron ore and coking coal.[29] Accordingly, the industry has been urged to use more scrap metal in steel production. This proved to be easier said than done because the supply of scrap metal stayed at about 75 to 80 million tons per year in the late 1970s. According to a Soviet source, the supply of scrap metal available for steelmaking amounted to about 65 million tons in 1980. The figure is inconsistent with other Soviet reports that about 50 percent of all crude steel was smelted from scrap metal during the late-1970s. For details, see Stal', No. 11, 1981.

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[25] See "USSR: Coal Industry Problem and Prospects, ER 80-10154," March 1980, pp. 5-6. (U) for an explanation of the methodology to estimate mine depletion in the coal industry. The estimates for mine depletion include both steam and coking coal. Since 1978, the Soviets have suspended detailed reporting for steam and coking coal. Our analysis may understate the severity of the depletion problem with respect to coking coal because the bulk of Soviet production comes from basins where the depletion problem appears most severe.

[26] G.A. Norotkov et al, "Vtorichnyye chernyye metally," Moscow: 1979, p. 5.

[27] Pravda, 22 January 1979, p. 1.

The lack of success in collecting more scrap metal seems to stem primarily from shortages of equipment to sort scrap metal and shortages of labor, especially skilled engineers. Soviet commentaries indicate that scrap-sorting procedures are slipshod; in many cases, only a perfunctory check is made to determine the type of scrap.[30] Wages in the scrap metal industry are reported to be low by Soviet standards, and it tends to attract low-quality engineers.

Finally, scrap collection is poorly coordinated and ineffective because of the diffusion of responsibility for collection among many ministeries for which the assignment is an unwelcome sideline. Some Soviet studies suggest that the amount of scrap "irretrievably lost" amounts to from 10 to 20 million tons per year in the machine-building and metalworking (MBMW) sector alone.[31] Because MBMW accounts for about 40 percent of annual Soviet steel consumption, the total amount of scrap metal wasted annually nationwide is much higher.[32]

Planners have complained about tight supplies of scrap metal for years. But in the past, planners had a fallback position. If supplies of scrap became uncomfortably tight, more pig iron could be used in the open-hearth furances (OHFs), which operate flexibly on pig iron and scrap. This option has become less available because of tight supplies of pig iron. Shortages of scrap metal curtail the operations of electric furnaces (EFs), which operate almost exclusively on it, and therefore these furnaces account for about 10 percent of Soviet steelmaking capacity.

OUTLOOK

PRODUCTION

The goals of the Eleventh Five-Year Plan (1981–85) resemble the production targets originally planned for 1980. Production of crude steel is scheduled to increase to 169 million tons by 1985, some 20 million tons more than 1980. Output of both rolled steel products and pig iron is to reach 118 million tons by 1985, while production of coking coal and iron ore is slated to rise by about 10 percent during the same period.[33] These goals are extremely dubious. The increments in production of crude steel, rolled steel, and pig iron would have to triple during 1981-85 compared with the increments during 1976-80. Coking coal production would have to jump by about 15 million tons during the current plan—another goal we consider unrealistic (see table 7). Shortfalls in the production of raw materials and in the introduction of new steelmaking capacity as well as stringent investment allocations will likely limit Soviet production of crude steel and rolled steel products to 155 million tons and 108 million tons, respectively, by 1985—about the same tonnage increase achieved during 1976-80.

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[28] Voprosy ekonomiki, No. 10, 1981, p. 122. The primary reason for lower investment is that electric furnaces are less costly than open-hearth furnaces.

[29] Stal', No. 8, 1979, p. 572.

[30] A. Voronov, USSR Deputy Minister of Ferrous Metallurgy, Pravda, June 9, 1979, p. 2.

[31] "Voprosy ekonomiki", No. 7, 1979, pp. 35–66. See also "Sovetskaya Rossiya," 24 March 1982, p. 1.

[32] N.P. Bannyy, op cit., p. 4.

Iron Ore.—Soviet production of iron ore probably will not exceed 255 million tons by 1985—about 10 million tons more than the 1980 total but some 20 million tons below the 1985 target. If the Soviets achieve planned 1985 iron ore production—275 million tons—the supply of ore would be sufficient to meet planned steel production in that year and maintain exports at 1980 levels. However, if our production estimate is reasonably accurate, the Soviets face an apparent supply gap of about 20 million tons by 1985.

To help balance domestic supply and demand of iron ore, the Soviets could trim exports (about 45 million tons per year),[34] boost imports (about 2 million tons per year), or try to make greater use of scrap metal in the OHFs and EFs. The last option will probably be limited by tight supplies of scrap metal.

TABLE 7.—ACTUAL AND PLANNED PRODUCTION OF STEEL AND RELATED PRODUCTS, 1981-85

[Million metric tons]

	Production		Approximate increments in production	
	Actual 1980	Plan 1985	Actual 1976-80	Plan (1981-85)
Crude steel	148	168	7.0	20
Rolled steel	103	118	4.0	15
Iron ore	245	275	12.0	30
Pig iron	107	118	4.0	11
Coking coal	178	193	−3.0	15

Eastern Europe presently accounts for about 90 percent of Soviet exports of iron ore. The Soviets could cover anticipated domestic requirements by cutting exports to Eastern Europe by 50 percent. But this policy would reduce Moscow's economic leverage over its client states, and any Soviet decision to lower iron ore exports to Eastern Europe is likely to be based mainly on political rather than strictly economic considerations. The Soviets might phase out exports to the West, but the amounts involved are comparatively small and most of the shipments are covered by long-term contracts.

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[33] Goals for crude steel, pig iron, iron ore, and coking coal are based in statements by the Minister of Ferrous Metals reported in Agitator, No. 13, 1981, pp. 31-33. See also, "Summary of World Broadcasts," SU/WII64/A/10, 11 December 1981, for details. The plan for rolled steel production is based on Soviet goals for the Eleventh Five Year Plan.

[34] This total includes both concentrated iron ore and iron ore pellets.

Although the Soviets could boost imports of iron ore, an increase from about 2 million tons in 1980 to 20 million tons by 1985 would push the cost up to roughly $1 billion at current market prices. Although the possibility of a sharp jump in Soviet iron ore imports cannot be dismissed, we still consider it unlikely because of the hard currency stringencies the USSR will face during the 1980s.

Unless some remedy is taken, lagging production of iron ore would by itself limit Soviet steel production to 160 million tons by 1985, some 8 million tons less than planned. This estimate assumes that supplies of coking coal and scrap metal are adequate to meet the planned goal for steel production.

Coking coal.—The Soviets will need about 210 to 215 million tons of coking coal to meet the 1985 plan for steel production and to hold allocations to other industrial users at 1980 levels, including export commitments. To reach this goal. Soviet production of coking coal would have to increase by about 35 million tons by 1985. If our estimate of mine depletion is reasonably correct, gross commissionings of new capacity would have to jump to about 170 million tons during 1981-85. Such an amount is unrealistic; it is almost twice the total commissionings in the coal industry during 1976-80 (including commissionings of steam coal). According to a rough calculation, the Soviets would have to invest from 5 to 9 billion rubles during 1981-85 to support commissionings of coking coal at this level.[35] The implied volume of investment is also unrealistic; at the upper end of the range it is about equal to total cumulative investment in all sectors of the coal industry during 1976-80.

Coking coal production probably will decline from about 175 million tons in 1981 to less than 170 million tons by the late 1980s because of reduced production in the Donets basin. As in the case of iron ore, the Soviets will be forced to adjust by trimming plans for steel production, increasing imports, cutting exports, changing the pattern of domestic allocations, or adopting some combination of these options.

Although we cannot predict how the Soviets will deal with shortages of coking coal, we can size the problems planners face. If the needs of the steel industry are met fully and the demands of all other consumers are held at or near 1980 levels (including export commitments), Soviet imports of clean coking coal would be about 30 million tons by 1985, about triple the average annual imports during the 1970s. At current market prices—$60 per ton—these imports would cost nearly $2 billion. If imports are not increased and the needs of the steel industry are fully met, coking coal allocations to nonsteel users would have to be cut by 25 percent by 1985—an infeasible solution since these sectors include electric power, petrochemicals, and nonferrous metals. Conversely, if allocations to nonsteel users are held at 1980 levels and imports are not increased, the supply of coking coal available for ferrous metallurgy would drop by about 4 percent by 1985, compared with 1980.

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[35] This estimate is based on the most recent available data on investment per ton of coal at selected Soviet basins. In the mid-1970s, such investment was 55 rubles and 30 rubles at the Donets and Kuznetsk basins, respectively. See Planovoye khozyaystvo, No. 6, 1975, p. 66 for details.

The USSR could also trim exports, especially to Eastern Europe, to help avert part of the supply crunch. This policy, however, would aggravate an already unstable situation caused by uncertainties in coal exports from Poland—a major supplier to other East European countries. Some reductions in sales to hard currency countries are possible but won't help much; the amounts involved are small. Moreover, most Soviet coking coal exports to hard currency countries are covered by long-term contracts.

Investment.—The priority to be given to investment in the steel industry is still unclear. In early 1981 the Minister of Ferrous Metals I. Kazanets said that investment in the industry would increase by 30 percent during 1981–85 compared with that during 1976–80, suggesting cumulative investment would have to be about 20 billion rubles in the current plan.[36] More recently, however, President Brezhnev announced that total fixed investment in the country would be cut by 30 billion rubles during 1981–85. How this overall cut would affect allocations for ferrous metals is unknown. The Soviets claim in addition that the share of investment allocated for improvement in quality of steel products will be doubled during the 1981–85 plan, with emphasis on substantially increasing production of cold-rolled steel, large-diameter steel pipe, and transformer steel.[37] Such claims, however, are not new; they have been a hallmark of Soviet plans since the mid-1960s.

We think, however, that because capital costs are increasing rapidly, investment increments at least on the order of those suggested by Minister Kazanets would be needed to recover the pre-1975 momentum of the industry. Indeed, according to Soviet studies investment requirements have been climbing in all important activities of steelmaking since the mid-1960s (see table 8). Investment per ton of rolled steel has almost doubled in the last 15 years. The Soviets cite a number of reasons for the increase in investment requirements. In ore mining, the steady decline in the average grade of the ore resulted in a 70-percent increase in investment per ton of ore during the 1970s alone. Although progress has been slow, the Soviets are producing relatively more sophisticated steel products (for example, cold-rolled sheet and tin plate) which requires additional rolling equipment, labor, and energy. Meanwhile, air and water pollution control equipment are taking a greater share of annual investments. The Soviets report that about 5 percent of annual investment in the steel industry is currently earmarked for pollution control; as recently as the mid-1960s the Soviets probably invested even less in pollution control equipment.[38]

TABLE 8.—REAL CAPITAL INVESTMENT PER TON OF ADDITIONAL IRON AND STEEL CAPACITY

[Rubles [1]]

	Iron ore [2]	Crude steel [3]	Rolled steel products [4]
1966–70	61	431.3	543
1971–75	([5])	586.1	797

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[36] Agitator, No. 13, 1981, pp. 31–33.

[37] Sotsialisticheskaya Industriya, 3 January 1982, p. 1.

[38] See Planovoye khozhahstvo, No. 3, 1977, p. 124, for details.

TABLE 8.—REAL CAPITAL INVESTMENT PER TON OF ADDITIONAL IRON AND STEEL CAPACITY—Continued

[Rubles [1]]

	Iron ore [2]	Crude steel [3]	Roiled steel products [4]
1976–80	102	760.5	1,005

[1] Although the sources are not specific, we believe that these prices are 1969 estimate prices for construction and 1973 wholesale prices for equipment adjusted by 1976 coefficients for construction and installation work.

[2] "Planovoye khozyaystvo," No. 8, 1979, p. 56.

[3] "Vestnik akademii nauk SSSR," No. 10, 1981, p. 72.

[4] N. P. Bannyy, "Ekonomika chernoy metallurgii SSSR," Moscow: 1978, p. 137.

[5] Not available.

RAW MATERIALS SHORTAGES HOLD BACK MODERNIZATION

Tight supplies of raw materials will retard the modernization of Soviet steelmaking capacity. A longstanding objective has been to replace much of the largely obsolete open-hearth furnace steelmaking capacity with the basic oxygen furnaces (BOF) and electric furnaces that are dominant in the rest of the world. Nonetheless, open-hearth furnaces still account for most of Soviet steel output. The BOF, despite its low operating cost and higher efficiency, requires about one-half more pig iron per ton of steel than OHF. To the extent that pig iron output is held back by slow growth in iron ore and coking coal supplies, conversions to the BOF will be delayed. Similarly, the availability of scrap metal will limit the pace at which the Soviets can install new EF capacity. Despite the fact that the EF requires less labor and is easier to maintain, it uses about twice as much scrap per ton of steel as an OHF and nearly five times more than a BOF (see table 9). Therefore the Soviets will probably continue to rely heavily on the OHF, which operates flexibly on pig iron or scrap metal.

TABLE 9.—PIG IRON AND SCRAP METAL REQUIREMENTS BY TYPE OF STEELMAKING FURNACE

Type of furnace	Pig iron			Scrap metal		
	Kilograms/metric ton	Pig iron charge as a percent of total metal charge	Estimated Soviet use (percent)	Kilograms/metric ton	Scrap metal charge as a percent of total metal charge	Estimated Soviet use (percent)
Open-hearth	600	0 to 100	55	500	0 to 100	45
Basic oxygen	925	70 to 80	80	215	20 to 30	20
Electric	150	0 to 15	13	990	85 to 100	87

Source: Battelle Columbus Laboratories, "Energy Efficiency in Soviet Ferrous Metallurgy," 15 October 1980.

According to original Soviet plans, electric furnace capacity was to increase by 60 percent during 1981–85—an increase from roughly 15 million tons in 1980 to more than 25 million tons in 1985.[39] This total probably includes about 2 million tons of new electric furnace capacity scheduled for the Stary Oskol plant near Kursk. Stary Oskol will use a direct-reduction iron process that eliminates the need for blast furnaces. In this process, an iron sponge with a ferrous content of about 92 percent is produced, which can be used in electric furnaces with small amounts of scrap metal. Originally set for completion in 1979, the plant is unlikely to begin turning out steel before 1985 because of construction problems. Aside from Stary Oskol, Soviet plans call for installation of about 5 to 6 million tons of scrap-based electric furnace capacity by 1985. To do this, however, would entail the commissioning of as much new electric furnace capacity during 1981–85 as was installed during the last decade, an unlikely outcome.[40] Part of the Soviet plan, for example, hinges on commissioning three scrap-based electric furnace plants in Moldavia, Belorussia, and the Soviet Far East. These plants, which will have a combined annual capacity of 1.5 million tons and require a capital investment of about 1 billion rubles, are scheduled for completion in 1984.[41] But because work on these plants still has not begun and construction times are long, the plants probably will not be fully operational until the late-1980s at the earliest.

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[39] "Summary of World Broadcasts" 27 November 1981, p. A14. A more recent source states that the Soviets are planning a 50-percent increase in electric furnace capacity during 1981–85. See, *Stal'* No. 3, 1982, p. 2 for details.

We believe that because of stringencies in scrap metal supply, the Soviets will be able to commission no more than 3 million tons of new electric furnace capacity by the mid-1980s. This new capacity would increase annual scrap metal demand by more than 2 million tons—about 50 percent of the increment in scrap metal supply the Soviets are likely to achieve by 1985. We project that the supply of scrap metal will increase from about 78 million tons in 1980 to 82 million tons in 1985, or an annual growth of about 1 percent. Various Soviet sources suggest that the supply of scrap metal increased by about 1 percent during 1976–80. A Soviet estimate indicates that the supply of scrap metal will have to increase to about 90 million tons by 1985, roughly 3 percent per annum, to meet fully the needs of the steel industry in that year. We believe this target is unrealistic unless Moscow takes unusually tough measures to marshal additional resources behind a stepped-up scrap metal recovery campaign.[42] In particular, increased scrap metal recovery will entail a sharp jump in rail haulage and possibly the diversion of additional highly trained labor. If scrap metal supplies became tight enough, the Soviet could trim exports, presently some 1 to 2 million tons per year.[43] Like reductions in exports of iron ore and coking coal, such a cutback would most seriously affect Eastern Europe.

The share of steel produced in BOFs and EFs was to rise to 32 percent and 12 percent, respectively, by 1980, while the OHF share was scheduled to drop to about 56 percent.[44] But these goals were not achieved (see table 10). In 1980, the OHF still accounted for over 60 percent of Soviet steel production, much more than other major steel-producing countries. In the 1981–85 Plan, the shares of steel produced in BOFs and EFs are to increase to 33 percent and

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[40] "Energy Efficiency in Soviet Ferrous Metals," Battelle Columbus Laboratories, 15 October 1980, p. 47.

[41] "Soviet Geography: Review and Translation," September 1981, pp. 448–452.

[42] Stal' No. 8, 1979, p. 572.

[43] Despite scrap shortages, Soviet exports rose from about 1.8 million tons in 1976 to about 2.5 million tons in 1980. A large portion of the scrap is exported to Japan and Italy and is probably covered by long-term contract.

[44] Stal', No. 2, 1979, p. 112.

16 percent, respectively; by 1985, the OHF share is supposed to drop to about 50 percent. The plan implies about a 15-million-ton increase in BOF-based steel, a 10-million-ton jump in EF-based steel, and a 5-million-ton drop in OHF steel, presumably by retiring some of the oldest OHF capacity.

TABLE 10.—STEELMAKING CAPACITY BY TYPE OF FURNACE IN THE U.S.S.R., UNITED STATES, AND JAPAN

[Percent]

	U.S.S.R.					United States 1980	Japan 1980
	1975	1980 plan	1980 actual	1985 plan	1985 estimate		
Open-hearth	65	56	61	51	58	12	....
Basic oxygen	25	32	29	33	29	61	75
Electric	10	12	10	16	13	27	25

Source: Data for the USSR are based primarily on "Kommunist vooruzhennikh sil," No. 15, 1981, pp. 21–23. Data for the United States and Japan taken from the Annual Statistical Report, American Iron and Steel Institute, 1980. (U)

Although the Soviets must modernize their steelmaking capacity, we doubt that much progress is possible during the current plan. More likely the share of steel produced in BOFs probably will not change much during 1981–85 because of raw material contraints. The Soviets should be able to raise the share of EF steel from about 10 percent in 1980 to 13 percent in 1985—only about half of the planned increase. The share of OHF steel probably will fall from about 61 percent in 1980 to 58 percent in 1985, still far higher than in other steel-producing countries.

In effect, by neglecting modernization, the Soviets seem to have painted themselves into a corner. They must modernize the steel industry to break the current logjam in production. At the same time, the Soviets will have to defer any major program to modernize steelmaking capacity as long as uncertainties exist in the supply of iron ore, coking coal, and scrap metal.

IMPORTS AS A SAFETY VALVE

Imports of steel products and Western technology will be one of the options open to Moscow in dealing with problems in the steel industry. The viability of this option will depend upon how severe the hard currency shortages will be and the priority accorded the iron and steel sector. Imports of large-diameter steel pipe will be critical for the construction of oil and gas pipelines. The proposed gas export pipeline alone will require several million tons of steel pipe.

The Soviets will not be able to produce pipe comparable in quality to imported pipe for the foreseeable future. Nor would the Soviets not forego pipe imports in favor of domestically produced pipe that operates at lower pressures. The imported 56-inch pipe operating at 75 atmospheres of pressure can deliver about 35 billion cubic meters of gas per year. The best the Soviets have available is a 48-inch pipe operating at 75 atmospheres or a 56-inch pipe operating at 55 atmospheres. These pipes can deliver about 19 and 21 billion cubic meters of gas per year, respectively.[45] In other words, the Soviets would have to produce nearly twice as much pipe to deliver the same amount of gas the imported pipe can handle. In terms of steel requirements, for every ton of pipe not imported, the Soviets would have to produce and install about 1.7 to 1.8 tons. The Soviets will continue to buy, at least until the mid-1980s, large amounts of cold-rolled sheet steel for machine building, automobiles, and consumer durables, tin plate for canning and packaging, and various types of high-quality products for use in transformers and electric motors.

The USSR will also need access to Western processing technology to reduce its dependence on imports of Western specialty steel and as part of an overall effort to modernize domestic steelmaking capacity. The French are helping to build the new Novolipetsk steel plant, which will produce 7 million tons of specialty steel per year when full capacity is achieved (1986 at the earliest). The West Germans are buiding a large plant near Kursk that reportdly will produce 4 million tons of steel per year when full capacity is achieved—perhaps by 1985. This plant will use the direct-reduction iron process, which eliminates the need for blast furnances and thus lowers the need for coking coal. Both Novolipetsk and Kursk are critical to Soviet steel development plans, especially for specialty steels.

If hard currency shortages force the Soviets to limit steel imports, Moscow could cut back production and cancel or stretch out projects that require large amounts of steel. Private automobiles, for example, account for about 2 to 3 percent of annual Soviet steel consumption, largely in the form of cold-rolled sheet steel, which, in turn, is a major Soviet import.[46] Moscow might therfore cut back on automobile production, reduce imports of cold-rolled sheet somewhat, and channel a greater portion of domestically produced sheet into higher priority applications. Similarly, the Soviets could stretch out plans for the completion of the BAM. Every kilometer of track requires about 150 tons of steel rails; completion of the BAM network will require about 500,000 tons of rails. Additional amounts of steel will be needed to build the bridges, tunnels, and ancillary facilities related to this project.

Annex

As a part of this paper, the development of the Soviet ferrous metals industry during 1975–85 was investigated using a large-scale multi-regional, cost minimizing, linear programming model. The model helped to identify the causes for the poor performance of the industry in 1980 and to assess the performance prospects of this industry.

A base case solution of the model for 1975 was used to develop a picture of Soviet steelmaking that goes beyond published data and to validate the model. To help determine those critical resources limiting production in 1980, we looked at how the Soviet steel industry adjusted to reduced energy and raw material supply and to less steel furnace capacity than was originally planned. For the longer term, we used scenario analysis to estimate steel production under different sets of assumptions with respect to energy, raw materials and steel furnance capacity availabilities in 1985. First, we estimated maximum feasible steel production given originally planned resource availabilities. Second, we estimated potential production given our best estimates of resource availabilities. In both cases, the model results were consistent with estimates of resource requirements and production possibilities derived independently, including from a recent UN study ("Demand for and Supply of Metallurgical Coke to 1985"—United Nations Publications, ECE/STEEL/35, Brussels, 1981).

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[45] "Stroitel'stvo truboprovodov," No. 5, 1981, p. 14.
[46] Derived from Avtomobi'lnaya promyshlennost', No. 11, 1979 p. 8.

TRANSPORT IN TROUBLE

By Holland Hunter* ** and Deborah A. Kaple***

CONTENTS

Page

I. Introduction and summary 217
II. Output trends and targets 218
  A. Freight traffic 218
  B. Passenger traffic 224
III. Current discussion of transport problems 229
  A. Complaints about "irrational shipments" 229
  B. Freight car shortages 231
IV. Transport sector input productivity 233
  A. Fixed capital plant and equipment 233
  B. Effectiveness of input use 234
  C. Operating labor costs in transport and communications 237
V. Policy issues 237
  A. The economy's need for transportation 237
  B. Ceilings and slack 239
  C. The outlook for Soviet containment of the switch from rail to road 240

TABLES

1. Annual freight traffic by various modes, USSR, 1965–1985 219
2. Railroad freight shipments, traffic, and annual average hauls by commodity group, USSR, for years 1965, 1970, 1975, and 1980 222
3. Annual common carrier truck traffic, USSR, 1965–1985 223
4. Annual non-common carrier truck traffic, USSR, 1965–1980 223
5. Estimated stock of trucks in agriculture and elsewhere, USSR, 1965–80 224
6. Annual long-distance passenger traffic, USSR, 1965–1980 224
7. Urban passenger traffic, USSR, 1965–1980 225
8. Estimated stock of passenger automobiles, USSR, 1965–80 226
9. Year-end length of public roads by type of surface, 1965–1980 226
10. Year-end capital stocks, USSR transport and communications sector, 1965–1985 233
11. Selected railroad and pipeline utilization measures, USSR, by year 1965–1985 234
12. Average annual operating labor force, in the transport and communications sector, USSR, 1965–1980 237

CHARTS

1. Railroad, oil and gas pipeline freight traffic in tons-kms, by year 1965–1980 actual and 1981–85 intended with line fitted to years 1970–78 220
2. Logs of truck stocks, and concrete/asphalt highway for 1965–1980; USSR with line fitted to passenger-car series 1970–78 228
3. Freight traffic densities, in tons-kms per km, USSR, by year, 1965–1980 actual and 1981 intended, with lines fitted to years 1970–75 236
4. Regression T and C output on GNP, 1965 to 1981 238
  Regression of total freight output on GSP, 1965 to 1981 238

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I. INTRODUCTION AND SUMMARY

This paper offers a broad sketch of the transport sector of the Soviet economy, intended to throw some light on its near-term prospects. Trend changes in the 1970s have exposed some major problems facing the sector and fragmentary evidence on intentions in the 11th FYP provide clues for government policy in dealing with these problems. Until recently the transport sector has met the economy's needs quite well; the central question now is whether it can continue to do so.

The Soviet economy requires a large volume of transport services because its resources and people are spread widely over a very large land mass. As fuel and raw materials near old centers become exhausted, they must be brought to major production areas over increasing distances. In comparison with North America and Europe, the USSR is poorly served by year-round water transport, and government policy has held back the development of an adequate highway system. Hence, until the recent expansion of oil and gas pipelines, the USSR has been heavily dependent on its overtaxed railroad network.

As the transport system has come under increasing strain, heated discussion in the USSR has identified many problems and proposed many remedies. We recount some of these here, concentrating, however, on the statistical background which provides a basis for evaluating the prospects of the sector.

In Soviet terms, our first question is whether transport "strain" is likely to turn into a "bottleneck."[1] A related question concerns investment: does the 11th FYP make adequate provision for the additions to transport capacity needed to fend off transport bottlenecks? Given distinctly lower priority by the regime, another question arises concerning the Soviet highway network: will the USSR be able to continue much longer denying the economy an adequate system of all-weather roads?

Though the evidence as of mid-1982 remains incomplete, it suggests that, overall, the transport sector will find it hard to support Soviet output growth in the first half of the 1980s. Modest output growth is placing smaller additional demands on the transport sector than it has borne in the past. Oil and gas pipelines have assumed a larger share of the burden, and this has helped. The railroads, however, appear to have reached a capacity ceiling under their present technology and they greatly need improved facilities. Even if the transportation sector as a whole meets the demands placed on it, there will be particular commodity movements (perhaps feed grains from ports to inland destinations), particular routes (the westbound exits from the Urals), and particular seasonal conditions (severe winters, for example), when transport operations will continue under great "strain."

It is too early to know whether adequate funds are going into the expansion of transport capacity. Even now, there is no sign that the policy of stringency towards transport investment has given way to generosity. In particular, inadequate funding for highway improvement is continuing, to the detriment of the Soviet economy and the welfare of Soviet citizens. At this time, huge sums are going into gas and oil pipeline construction, and the Baikal-Amur Mainline (BAM) continue to be a show-case project. However, there is little evidence to suggest that the railroads will get the new motive power, rolling stock, and line facilities they need, or that the need for farm-to-market roads has been recognized. Since 1982 transport results were poor, 1983–1985 investment assignments ought to shift towards railroads and rural roads.

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[1] The bottleneck concept is briefly discussed in H. Hunter, "Transportation as a Factor in Plan Fulfillment," "NATO Economics Colloquium 1982" (in press).

II. OUTPUT TRENDS AND TARGETS

A. FREIGHT TRAFFIC

The Soviet economy has continued to generate a large volume of heavy freight traffic, though its rate of growth has slowed down since 1975. Table 1 shows the annual volume of ton-kilometers carried by the various transport modes. Transport of oil and natural gas by pipeline has risen very dramatically, and the pipeline share of total freight traffic is expected to continue rising during the first half of the 1980s.[2] By contrast the railroads, after a long era of successful expansion, have faltered since 1975. Soviet maritime freight traffic has expanded as Soviet foreign trade has grown, but its coastal traffic, like that on internal waterways, is hampered by long freezing periods and poor geographic connections. The series for truck traffic in Table 1 cover both common-carrier trucks and those owned by factories, farms, construction firms, and other organizations; most of it involves very short distances.

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[2] Further detail on the length of oil and gas pipelines, and their annual traffic is provided in ibid.

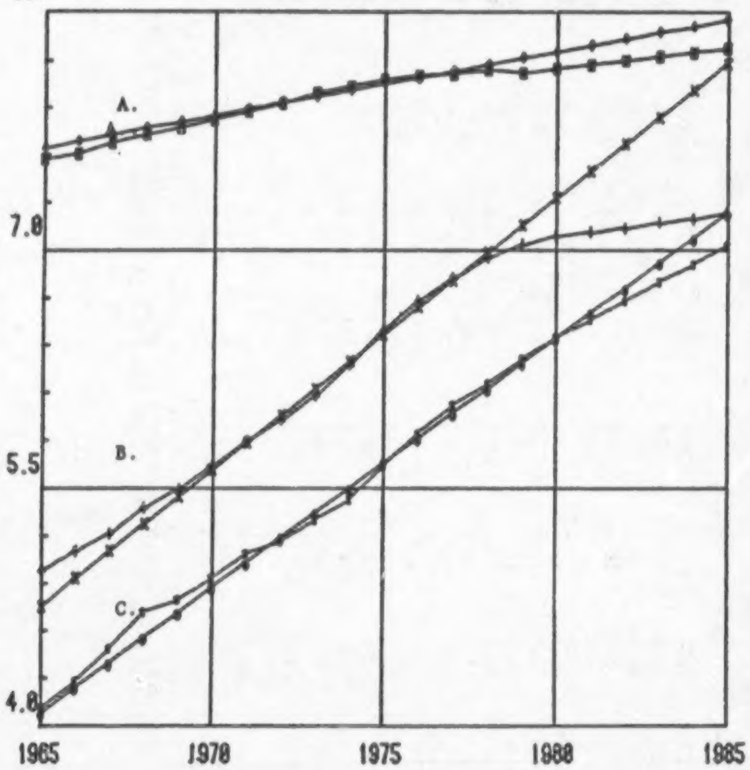
TABLE 1.—ANNUAL FREIGHT TRAFFIC BY VARIOUS MODES, U.S.S.R., 1965–85, IN BILLIONS OF METRIC TON-KILOMETERS

	Railroad revenue freight	Industry rail sidings	Oil pipelines	Gas pipelines	Maritime freight	Common carrier truck	Noncommon carrier truck	Internal waterways	Common carrier air	Common carrer subtotal	Total freight
1965	1,950.2	44.2	146.7	60.9	388.8	50.2	92.9	133.9	1.3	2,732.1	2,869.2
1966	2,016.0	46.9	165.0	72.2	442.8	52.2	103.1	137.7	1.4	2,887.3	3,037.3
1967	2,160.5	47.8	183.4	88.3	527.1	55.8	114.4	143.9	1.7	3,160.6	3,322.8
1968	2,274.8	50.1	215.9	111.0	586.8	57.5	129.6	155.4	1.8	3,403.2	3,582.9
1969	2,367.1	51.9	244.6	120.2	601.3	59.7	140.4	160.1	1.9	3,555.0	3,747.3
1970	2,494.7	55.3	281.7	137.7	656.1	64.2	156.6	174.0	1.9	3,810.2	4,022.1
1971	2,637.3	58.2	328.5	159.8	696.0	68.9	171.5	183.8	2.0	4,076.3	4,306.0
1972	2,760.8	58.9	375.9	173.3	698.4	73.6	184.5	180.3	2.2	4,264.5	4,507.9
1973	2.958.0	62.8	439.4	198.3	750.7	80.9	202.9	189.5	2.4	4,619.2	4,884.9
1974	3.097.7	68.4	533.4	224.8	778.1	89.2	223.3	212.3	2.5	4,938.0	5,229.7
1975	3,236.5	70.9	665.9	279.3	736.3	96.9	241.0	221.7	2.6	5,239.2	5,551.1
1976	3,295.4	71.6	794.6	344.0	762.2	102.6	252.5	222.7	2.7	5,524.2	5,848.3
1977	3,330.9	72.4	922.4	409.9	772.6	109.3	264.0	230.7	2.8	5,778.6	6,115.0
1978	3,429.4	74.3	1,049.1	469.4	827.6	115.8	279.4	243.7	2.9	6,137.8	6,491.5
1979	3,349.3	71.8	1,140.7	548.0	851.1	123.4	284.5	232.7	2.9	6,248.1	6,604.4
1980	3,439.9	76.7	1,196.8	626.7	848.3	131.4	300.9	244.9	3.1	6,491.1	6,868.7
1981	3,503.2	78.8	1,231.5	703.8	862.7	140.0	314.0	255.0	3.2	6,699.3	7,092.1
1982	3,603.4	80.9	1,267.2	790.3	877,5	144.6	326.0	262.9	3.3	6,949.2	7,356.1
1983	3.706.4	83.1	1.304.0	887.6	892.5	149.3	338.4	272.0	3.45	7,215.7	7,637.2
1984	3,812.4	85.4	1,341.8	996.7	907.7	154.2	351.3	282.5	3.5	7,498.8	7,935.5
1985	3,921.4	87.7	1,380.7	1,119.3	923.2	159.3	364.7	291.4	3.7	7,799.0	8,251.4

Sources: 1965–80 data compiled from TsSU Narodnoe khoziaistvo volumes adjusted for slight coverage changes. The gas pipeline series is derived from estimates in I. Ia. Furman, Ekonomika magistral' nogo transporta gaza (1978). 1981 results are from Ekonomicheskaya gazeta, No. 5, 1982. The 1985 targets are mainly from V.E. Biriukov, Transport v odinnadtsatoi piatiletke (1981), and 1982–84 estimates are logarithmic interpolations.

CHART 1

Railroad, Oil and Gas Pipeline Freight Traffic in
ton-kms, USSR, By Year 1165-1980 Actual and
1981-85 Intended, with lines fitted to years 1970-78



A. Log of rail freight traffic output in ton-kms.
B. Log of oil pipeline freight traffic output in ton-kms.
C. Log of gas pipeline freight traffic output in ton-kms.

Soviet rail freight transportation is dominated by the movement of primary commodities: fuels, ores, building materials, etc. The commodity-group pattern is indicated in Table 2, showing the volume of shipments, length of haul, and traffic volume for the major categories recognized in Soviet railroad statistics. Manufactured goods are buried within the "other freight" category, accounting for only 19 percent of the tons shipped and 26 percent of the ton-kilometers in 1980.

Detailed scrutiny of Table 2 discloses a general tendency for the average distance over which railroad freight moves to increase, reflecting the need to reach farther and farther for the fuels and raw materials on which heavy industry depends. Lengthening hauls are pronounced for timber and evident for iron and steel as well as ores and "other" freight. Longer hauls for "other" freight also reflect a long-standing effort to shift short-haul traffic from railroads to trucks. Like railroads everywhere, Soviet railroads prefer long-haul traffic.

Intercity movement of freight by truck has only recently become significant in the USSR. The data in Tables 3 and 4 show the activity of common-carrier trucks and trucks operated by other organizations in moving a large volume of miscellaneous freight for short distances. Around cities, at construction sites, and in the countryside, several million trucks (mainly 2.5-ton, 2-axle models), carry supplies and often people for distances averaging about ten miles. Soviet planners abhor empty backhauls and have long sought to channel truck shipments through local common-carrier trucking organizations. Tables 3 and 4 show, however, that non-common-carrier traffic has nevertheless raised its share of total trucking ton-kilometers from 65 to 70 percent between 1965 and 1980. The average length of haul for common carrier traffic has risen from 15 to 20 kilometers over this period, while for other trucks the average haul has risen from 13 to 17 kilometers.

TABLE 2.—RAILROAD FREIGHT SHIPMENTS, TRAFFIC, AND ANNUAL AVERAGE HAULS BY COMMODITY GROUP, U.S.S.R. FOR YEARS 1965, 1970, 1975, and 1980

	Freight traffic in billion ton-kms.				Tons originated in millions				Average length of haul in kilometers			
	1965	1970	1975	1980	1965	1970	1975	1980	1965	1970	1975	1980
Coal	374.4	424.6	498.0	598.8	552.6	613.9	716.9	731.6	678	692	695	818
Petroleum	280.4	353.9	481.4	460.8	222.2	302.8	389.0	422.7	1,262	1,169	1,238	1,090
Mineral building materials	226.5	300.0	440.5	456.5	573.2	691.0	946.8	956.5	395	434	465	477
Iron and steel	140.8	192.1	258.3	279.3	111.7	141.6	183.1	191.8	1,261	1,357	1,411	1,456
Timber	263.0	294.5	307.7	251.8	175.1	178.8	187.0	146.9	1,502	1,647	1,645	1,714
Ores	109.4	169.5	232.0	236.6	191.2	245.6	307.8	315.7	572	690	754	749
Grain	83.7	111.3	127.9	137.1	88.5	106.1	122.0	135.2	946	1,049	1,048	1,014
Fertilizer	46.5	70.9	112.2	124.9	42.9	70.9	106.1	115.8	1,084	1,000	1,057	1,079
Other	425.5	577.9	778.5	894.1	457.9	545.3	662.4	712.0	929	1,060	1,175	1,256
Total	1,950.2	2,494.7	3,236.5	3,439.9	2,415.3	2,896.0	3,621.1	3,728.2	807	861	894	923

Source: TsSU "Narodnoe Khozyaistvo v 1980 g.," pp. 295–96.

TABLE 3.—ANNUAL COMMON CARRIER TRUCK TRAFFIC, U.S.S.R., 1965–85

	Billion ton-kms	Million tons originated	Average haul in kms
1965	50.2	3,287	15.3
1966	52.2	3,357	15.5
1967	55.8	3,503	15.9
1968	57.5	3,518	16.3
1969	59.7	3,619	16.5
1970	64.2	3,810	16.8
1971	68.9	4,017	17.1
1972	73.6	4,251	17.3
1973	80.9	4,629	17.5
1974	89.2	5,026	17.8
1975	96.9	5,404	17.9
1976	102.6	5,742	17.9
1977	109.3	5,930	18.4
1978	115.8	6,177	18.7
1979	123.4	6,270	19.7
1980	131.4	6,456	20.4
1981	140.0		
1982	146.5		
1983	157.5		
1984	169.3		
1985	174.2		

Sources: TsSU, various volumes of Narodnoe khoziaistvo, plus Biriukov, op. cit.

TABLE 4.—ANNUAL NONCOMMON CARRIER TRUCK TRAFFIC, U.S.S.R., 1965–80

	Billion ton-kms	Million tons originated	Average haul in kms
1965	92.9	7,459	12.5
1966	103.1	8,100	12.7
1967	114.4	8,444	13.5
1968	129.6	9,282	14.0
1969	140.4	9,773	14.4
1970	156.6	10,813	14.5
1971	171.5	11,671	14.7
1972	184.5	12,453	14.8
1973	202.9	13,615	14.9
1974	223.3	14,618	15.3
1975	241.0	15,510	15.5
1976	252.5	15,849	15.9
1977	264.0	16,293	16.2
1978	279.4	16,946	16.5
1979	284.5	16,905	16.8
1980	300.9	17,686	17.0

Sources: Total less common-carrier truck traffic, as compiled by TsSU.

The number of trucks in the USSR, modest by Western standards, has grown steadily for many years. Rough estimates of the numbers available in agriculture and elsewhere are presented in Table 5. The trucks on hand in agriculture are reported annually in Narodnoe khoziaistvo, but the economy-wide total must be derived from annual production-plus-imports-minus-exports data to which assumed attrition rates are applied. The series in Table 5 applies a 6.8% attrition rate (which used to fit the agricultural truck data), though a 10% or 15% scrappage rate has recently been evident in agriculture. The resulting estimate of 5.1 million trucks in the USSR at the end of 1980 is lower than a CIA estimate of 10 million at the end of 1979, and a Motor Vehicle Manufacturers Association estimate of 6.2 million at the end of 1978. About one-third of the estimated total are assigned to agricultural organizations; their share has remained fairly stable for the last 15 years. Soviet trucks are subject to heavy wear and tear, and are frequently out of service, but they are retained for a period well beyond normal Western practice.

TABLE 5.—ESTIMATED STOCK OF TRUCKS IN AGRICULTURE AND ELSEWHERE, U.S.S.R., 1965–80

[In thousands]

	Agriculture	Other	Total
1965	982	1,753	2,735
1966	1,017	1,769	2,786
1967	1,054	1,799	2,853
1968	1,097	1,857	2,954
1969	1,153	1,915	3,068
1970	1,206	1,984	3,190
1971	1,168	2,179	3,347
1972	1,232	2,292	3,524
1973	1,276	2,441	3,717
1974	1,336	2,588	3,924
1975	1,396	2,749	4,145
1976	1,442	2,876	4,318
1977	1,501	3,013	4,514
1978	1,528	3,177	4,705
1979	1,568	3,325	4,893
1980	1,596	3,457	5,053

Sources: The trucks-in-agriculture series is from various Narkhoz volumes. The 1980 volume gives 1965 and 1970 figures evidently excluding tank trucks; 1966–69 figures above are interpolated in (changing) proportion to the old series, given the 1965 and 1970 benchmarks. For total trucks, see text. Trucks outside agriculture obtained by subtraction.

B. PASSENGER TRAFFIC

Table 6 shows the total number of long-distance passenger-kilometers handled, annually since 1965, by the various modes in the USSR. One notes a striking rise in the volume of long-distance passenger movement by autobus. The bus has had a pronounced impact on mobility outside Soviet cities. Over long distances, passenger movement by air has also become very important. The table does not show, however, the volume of travel by individual passenger automobile, since it is not estimated by Soviet statisticians. One might guess, however, that in 1980 each of some seven million Soviet passenger cars racked up an average of 4 thousand kilometers for the year outside cities, carrying 3 people. If so, this would indicate a passenger-car total of something like 80 billion passenger-kilometers, compared to almost 400 by bus, over 300 by railroad, and 160 by air.

TABLE 6.—ANNUAL LONG-DISTANCE PASSENGER TRAFFIC, U.S.S.R., 1965–80

[In billions of passenger kilometers]

	Bus	Rail	Air	River	Sea	Total
1965	120.5	201.6	38.1	4.9	1.5	366.6
1966	137.0	219.4	45.1	5.2	1.6	408.3
1967	153.0	234.4	53.5	5.3	1.7	447.9
1968	168.5	254.1	62.1	5.4	1.8	491.9

TABLE 6.—ANNUAL LONG-DISTANCE PASSENGER TRAFFIC, U.S.S.R., 1965–80—Continued

[In billions of passenger kilometers]

	Bus	Rail	Air	River	Sea	Total
1969	183.0	261.2	71.5	5.5	1.7	522.9
1970	202.5	265.4	78.2	5.4	1.6	553.1
1971	215.8	274.6	88.8	5.7	1.7	586.6
1972	235.6	285.8	95.9	5.7	1.9	624.9
1973	253.9	296.6	98.8	5.9	1.9	657.1
1974	279.1	306.6	108.8	6.1	2.0	702.6
1975	303.6	312.5	122.6	6.3	2.1	747.1
1976	325.3	315.1	130.8	6.0	2.5	779.7
1977	344.5	322.2	127.5	5.6	2.7	802.5
1978	361.5	332.1	140.1	5.8	2.3	841.8
1979	376.0	335.3	151.0	5.8	2.5	870.6
1980	389.8	332.1	160.6	6.1	2.5	891.1

Sources: TsSU, various volumes of Narodnoe khoziaistvo.

Turning to urban passenger transportation, we see in Table 7 that its total volume continues to grow steadily. Public transport is still thriving in the USSR. The Moscow subway system is growing, and subways have been built in Leningrad, Kiev, Kharkov, Tashkent, Tbilisi, and Baku. Autobuses operate in some 400 Soviet cities; trolleybuses and/or streetcars in 272. Under the impact of continued urban growth, Soviet cities are spreading out, but residences are predominantly in apartment buildings, rather than individual homes, thus providing a density which makes public transport feasible.

TABLE 7.—URBAN PASSENGER TRAFFIC, U.S.S.R., 1965–80

[In billions of passengers carried]

	Urban bus	Suburban bus	Trolley bus	Street car	Metro	Suburban rail	Taxi	Total
1965	14.4	3.4	4.3	8.2	1.7	2.1	0.7	34.8
1966	15.7	3.8	4.7	8.2	1.8	2.2	.8	37.2
1967	16.8	4.1	5.0	8.1	1.9	2.3	.8	39.0
1968	17.7	4.5	5.3	8.0	2.0	2.4	.9	40.8
1969	18.7	4.8	5.7	7.8	2.2	2.5	1.0	42.7
1970	20.5	5.4	6.1	8.0	2.3	2.6	1.1	46.0
1971	21.3	6.0	6.6	8.0	2.4	2.7	1.3	48.3
1972	22.2	6.5	7.0	7.9	2.6	2.8	1.4	50.4
1973	23.6	6.9	7.2	8.0	2.7	3.0	1.5	52.9
1974	25.1	7.3	7.6	8.1	2.8	3.0	1.6	55.5
1975	26.9	7.7	8.0	8.2	3.0	3.1	1.7	58.6
1976	27.6	8.3	8.3	8.3	3.2	3.2	1.8	60.7
1977	28.0	9.3	8.6	8.4	3.4	3.2	1.2	62.1
1978	27.7	10.6	8.8	8.4	3.5	3.3	1.1	63.4
1979	28.3	10.9	8.9	8.3	3.7	3.2	1.2	64.5
1980	28.6	11.6	9.0	8.3	3.8	3.2	1.4	65.9

Sources: TsSU, various volumes of Narodnoe khoziaistvo.

Table 8 shows two estimates for the stock of passenger automobiles in the USSR, annually, since 1965. After the ouster of N. S. Khrushchev in 1964, the long-standing policy of repressing the passenger automobile was relaxed and rapid growth ensued, especially in the first half of the 1970s. It has since slowed down, suggesting a renewed policy of government restraint. In any case, it seems clear that the passenger automobile is not undermining urban public transport in the USSR, and is not yet a major factor in long-distance travel.

TABLE 8.—ESTIMATED STOCK OF PASSENGER AUTOMOBILES, U.S.S.R., 1965–80

[In thousands]

	Assumed 0.05 attrition rate	MVMA estimate
1965	1,093.8	926
1966	1,174.6	995
1967	1,266.2	1,100
1968	1,363.2	1,250
1969	1,470.4	1,560
1970	1,607.4	1,650
1971	1,854.5	1,300
1972	2,239.6	
1973	2,744.2	1,815
1974	3,365.8	3,781
1975	4,025.1	4,730
1976	4,632.6	3,000
1977	5,223.6	5,660
1978	5,780.7	6,600
1979	6,307.7	7,000
1980	6,857.9	

Sources: Column 1 applies a 5 percent attrition rate to production-plus-imports-minus-exports data from Narkhoz and Vneshniaia torgovlia volumes covering 1945–80. Column 2 is from various years of the Motor Vehicle Manufacturers Association "Facts and Figures" (Detroit, Mich.).

The Bolsheviks inherited a tradition of "roadlessness" from Tsarist Russia and have yet to tackle the problem seriously. Since World War II, city streets have been paved, and major interregional roads have been improved, but the growth of a highway system outside cities has been systematically stunted by comparison with what one sees in developed societies throughout the world. Table 9 shows the length of paved and other hard-surfaced roads in the USSR and though the total seems large it is woefully small in relation even to the settled area of the country. Moreover, the annual figures show that while the length of paved highway (concrete or asphalt surfaced) has risen almost three-fold from 1965 through 1980, the length of other hard-surfaced roads (graded gravel, etc.) has risen only 57%, in the face of an 85% rise in the number of trucks and a more than six-fold increase in the number of passenger automobiles. The 11th FYP targets for highway construction merely continue the modest growth rates of the 1970s.

TABLE 9.—YEAR-END LENGTH OF PUBLIC ROADS, BY TYPE OF SURFACE, 1965–80

[In thousands of kilometers]

	Concrete or asphalt	Other hard-surfaced	Other	Total
1965	131	229	710	1,070
1966	145	242	691	1,078
1967	160	243	685	1,088
1968	175	260	651	1,086
1969	189	272	633	1,094
1970	205	284	617	1,106
1971	221	292	575	1,088
1972	237	299	522	1,058
1973	255	308	501	1,064

TABLE 9.—YEAR-END LENGTH OF PUBLIC ROADS, BY TYPE OF SURFACE, 1965–80—Continued

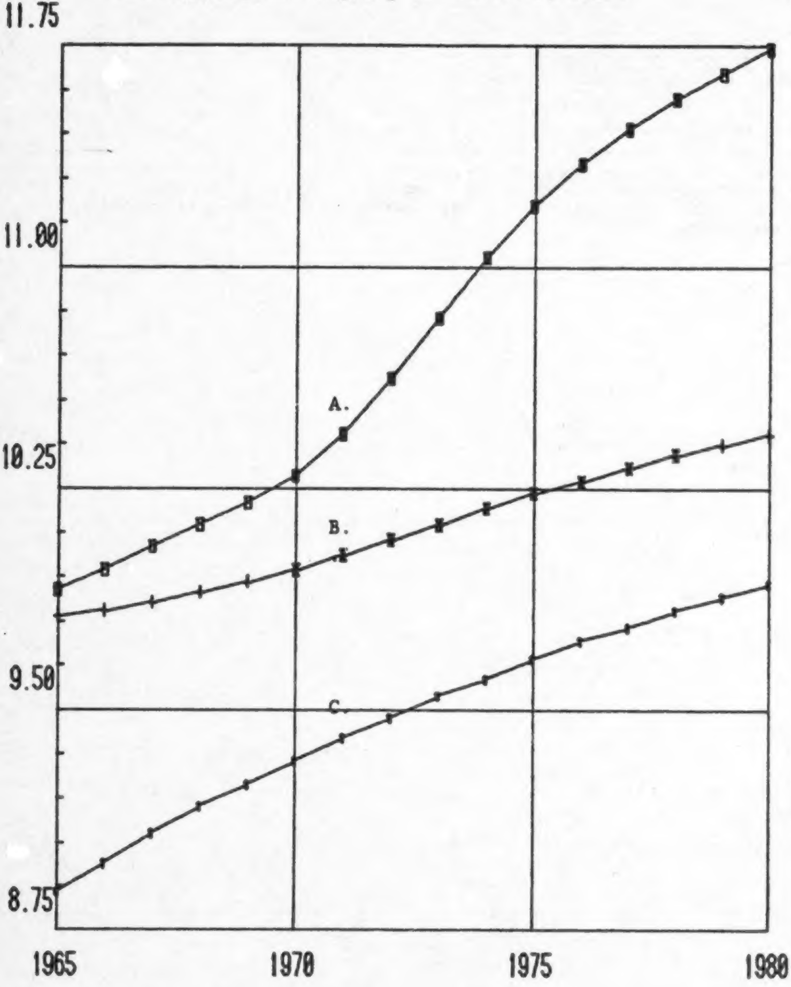
[In thousands of kilometers]

	Concrete or asphalt	Other hard-surfaced	Other	Total
1974	271	318	470	1,059
1975	290	328	404	1,022
1976	308	334	371	1,013
1977	323	342	350	1,015
1978	341	348	337	1,026
1979	358	355	312	1,025
1980	373	359	290	1,022

Sources: The 1980 Narkhoz volume distinguishes between public ("common carrier") roads and the roads administered by organizations like timber enterprises, and gives data for 1965, 1970, and 1976–80. Figures above for 1966–69 and 1971–74 are interpolated in proportion to the previous series combining the two.

CHART 2

Logs of passenger-car stocks, truck stocks, and concrete/asphalt highway for 1965-80, USSR.



A. Log of passenger-car stocks, in thousands
B. Log of truck stocks, in thousands
C. Log of length of concrete/asphault highway, in kilometers

The failure to build an adequate highway system has penalized the agricultural sector very heavily for years. Farm-to-market roads are an important component of efficient agriculture throughout the world, yet Soviet authorities have ignored the contribution they can make. Even now, in introducing another special high-priority "food program," L. I. Brezhnev only mentioned roads toward the end of his address, in connection with " . . an increase in State assistance for housing construction and for the construction and maintenance of children's preschool institutions, Young Pioneer camps, clubs and other cultural and consumer-service facilities and roads on low-profitability and unprofitable collective farms." [3]

III. Current Discussion of Transport Problems

A. COMPLAINTS ABOUT "IRRATIONAL SHIPMENTS"

One cannot deny that the economic success of any country depends to a great extent on the country's transportation system. For a country like the Soviet Union, with its vast expanses of land, this is especially true. In general, the USSR's valuable mineral resources and fuels are located in Siberia and must be transported for use in European Russia and the Urals area, agricultural products produced in the south must be transported to other regions of the country, and goods produced in central USSR must also be shipped across the country. State ownership dictates that all models of transport be interdependent, thus forming the "Unified Transport System of the USSR." This "system" is often referred to as the "circulation" of the economy, or even as the country's "nervous system," denoting its importance in the functioning of the economy as a whole.[4] As we shall demonstrate, however, this centrally-planned system often works against itself precisely because all modes are state-owned.

The sheer numbers of kilometers which make up this "system" easily demonstrate that the USSR has one of the largest transportation sectors of any country in the world. As a system, then, more than 12.5 billion tons of various types of freight in 1975, as well as about 38 billion passengers, were transported.[5] In 1980, this system included 142.8 thousand kilometers of mainline railroad, 141 thousand kilometers of distributory rail lines which belong to production enterprises, 142 thousand kilometers of inner navigable rivers, 1,358 thousand kilometers of roads, 57.5 thousand kilometers of main oil pipelines and 132 thousand kilometers of main gas pipelines.[6]

The figures above are interesting, and they do tell a story about one of the biggest transportation systems in the world. A more telling way of assessing the system, however, is to take a look at how this system functions and how well it does the job it must do. Problems concerning efficiency and labor productivity in transportation surface again and again in the Soviet press, especially from those enterprises and factories which must depend upon it for their own livelihood. Several of these complaints have been aired many times in the past and may be indicative of larger, perhaps systemic, problems, much more complex than those of one factory manager or transport official. We will review some of the problems which are drawn to our attention in this manner, and other problems which are not so obvious, as part of an attempt to discern whether or not the transportation system is likely to constrain Soviet economic output in the near future.

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[3] Pravda, May 25, 1982, p. 2; English text in "Current Digest of the Soviet Press," Vol. XXXIV, No. 21 (June 23, 1982), p. 7.

[4] See S. K. Danilov, "Ekonomicheskaya geografika transporta SSSR" (Moscow: Transport, 1977), p. 30 and Vasiliy Selyunin, "Nerv ekonomiki" in Druzhba narodov, No. 11, 1981, pp. 178–192.

[5] Danilov, ibid., p. 30.

[6] See "Edinaya transportnaya sistema SSSR" in Ekonomicheskaya gazeta, No. 16, April 1982, p. 1, and "Razvitiye truboprovodnogo transporta" in Ekonomicheskaya gazeta, No. 43, October 1981, p. 2.

Nearly every Soviet press article on freight transportation begins by outlining just how much freight is or was transported yearly, or how much the volume of freight traffic has grown in the years since the revolution, and so forth. These articles detail all successes in terms of numbers of ton-kilometers shipped, a measure which does indeed show the impressive amount of freight which the Soviets transport, but tells us nothing about the efficiency of the system. Relying on the ton-kilometer as an economic indicator allows the system many inefficiencies, and encourages transport workers to stress areas which are not always the most productive. What typically happens is illustrated by N. F. Maslennikov, Deputy Director of the Southeast Railway, in the following example. Last year his railway hauled 3.5 million tons of freight for relatively short distances of 70 to 80 kilometers. It would have been much more economical to make these short-distance deliveries by truck, but, as he noted, ". . . in their pursuit of ton-kilometers, truck drivers do not want to haul freight for short distances." In fact, he noted, they will gladly carry heavy loads for great distances.[7]

Rail still dominates the shipping of goods across the Soviet Union, which has been a dictate of the geography of the country. However, it is has been obvious to the Soviet planners that it is more economical to increase the share of petroleum and gas moved by pipeline. One seasoned observer of the Soviet rail scene recently stated that the Soviet economy wastes about 50 to 55 million tons of excess freight per year due to the serious shortcomings in rail transportation. These include such problems as "underloading," which not only ties up the freight cars, but causes problems for those enterprises which are expecting shipments of a certain size. Another related problem, although not the fault of the transport workers, is the fact that prior processing of heavy freight is inadequate. Therefore, much capacity for freight traffic is underutilized, because once a load of coal, for instance, reaches its destination, and the coal is separated from the dirt, the cars may as well have made the trip half empty.[8]

The complaint heard most often of all is that of "irrational shipping of goods." There are countless examples of fuel oil or some other raw material being shipped across the country, instead of simply being driven to a factory which is located 20 kilometers away from the source. The problem is so extensive that an interdepartmental commission on the rationalization of freight was created in Gosplan USSR to decrease the long interregional shipments. For ten years this commission has been advising the manufacturers of prefabricated reinforced concrete to deliver output to their neighbors and not to ship it throughout the entire country. As one Soviet scholar put it, though, the commission's advice on this issue was "a voice crying in the wilderness." [9] Whether this commission will be able to solve any of the problems, or whether it will be given the authority, remains to be seen.

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[7] V. Parfenov and A. Starukhin, "Kak ukrepit' vzaimodeistviye," Pravda, Apr. 26, 1982, p. 2.
[8] L. Nikishin, "Beskhodniy ugol'," Pravda, Feb. 25, 1982, p. 3.

B. FREIGHT CAR SHORTAGES

The problems underlying a simple complaint of a transport official at a certain enterprise are often much more complex than they appear. Sometimes a factory manager or transport official will list the transportation problems his enterprise experiences, which are generally outside the realm of his control, and then he may, for example, present his own good record of performance. Other articles may be written only to lay blame on other organizations, and some detail their own problems and unique solutions in response to common transport difficulties.[10] Therefore, it is often difficult to judge the importance of the individual complaints. One complaint which inevitably surfaces, however, is that there is a shortage of freight cars, and that those in circulation are not being used correctly.

The access rail lines of industrial enterprises and the loading and unloading operations at transshipment areas are most often cited as the major bottlenecks for freight traffic. Many times, factories, enterprises, mines and construction sites are extremely slow about unloading freight and returning the cars. Transport officials recently estimated that at any one time there might be hundreds of cars "locked up" in the railroad network, which means that various types of freight are not delivered to customers on time. One rail official in the Karaganda division of the Alma-Alta Rail road reports that they regularly receive cars back containing freight which was never unloaded, especially coal.[11]

Others maintain that there are plenty of rail cars to go around but that many of them are in various stages of disrepair. According to this line of thinking, the perceived shortage exists often because the enterprise will be able to utilize only a few of those cars it receives, due to their poor condition.[11] Not only are the cars in bad shape, but the track and other rail transport structures are often in need of repair. One author blamed the Railroad Ministry (MPS) itself for this oversight, noting that the MPS pays little attention to track maintenance. Therefore, at the beginning of each winter, which is obviously the hardest season of all for rail transport, there are many unfinished plans of capital repairs on track and roadbeds, and other outdoor structures. The same goes for railroad bridges, of which there are over 50 thousand.

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[9] V. Seliyunin, op. cit., p. 181.

[10] A. V. Grishin, "Zavod i zheleznaya doroga," Ekonomicheskaya gazeta, No. 21, May 1982, p. 10.

[11] L. Nikishin, op. cit., p. 3.

In October, 1981, a study was undertaken to ascertain exactly how a large quantity of agricultural freight managed to accumulate on the wharves of Leningrad.[12] Several factors complicated the entire chain of events. First of all, the plan called for each rail car to be loaded with no less than 64 tons of grain, and, unfortunately, the rolling stock which arrived was comprised of up to 30 percent hoppers with capacity of no more than 35 tons each. On September 8, the port received 260 empty cars for grain, but 198 of them were low-capacity hoppers.

On subsequent days the number of empty cars far exceeded the original plan, but still there was an accumulation of grain. Indicative of the problems encountered by shippers is the freight cars which arrived to take grain out on September 11. Of the 48 cars which arrived, only 12 could be immediately dispatched. Dirt was found in 17 cars, 11 needed repair, and 8 of them were suitable only for industrial freight. As the author pointed out, all of these cars had been designated for hauling grain.

One of the main reasons for the poor quality of repair work and washing done at the check-points for rail cars is the Soviets' reliance on the standard boxcar. This reluctance to provide special-purpose cars means that dirty and often nonfunctional cars are supplied. In the case of the grain buildup on the Leningrad ports, even cars which had already passed through the check points and were sent to the ports for grain pick-up were rejected. Some of the cars were found to have broken doors, floors littered with broken glass, straw, and dirty paper, floors and walls splattered with lime, and so on. Even the better-quality cars which were loaded with grain were in poor condition; many of them had holes in the doors which were plugged with paper. As the author points out, though, once these paperstuffed holes are soaked with rain, the grain gets wet. A great deal of grain then leaks onto the rails through the holes; that which stays begins to rot. The grain loss can be substantial.

How interested has the Soviet government been in actually contributing to a reduction of transport costs? Just a cursory look at the structure of investment in both the transportation and communications (T & C) sector and, within this, the investment in rail transport, will give an idea about economic priorities. For the First Five-Year plan (FYP), 17.7 percent of the entire plan was invested in transport and communications, 10.2 percent of which went to rail. By the fifth FYP, the T & C share had dropped to 9.7 percent, and rail's corresponding share dropped to 4.9 percent, and for the year 1980, the shares were 12.1 percent and 2.9 percent respectively. This means that of all types of transportation, rail received only 24 percent of the allocation of T & C's investment, and nevertheless managed to transport 55.6 percent of all freight.[13]

Much has already been said about the poor quality of available rolling stock, and how the correct car for specific jobs is often not available. There is too little evidence to tell whether there really are enough freight cars in stock for use in the national economy. It is possible, however, to surmise that the use of them may not be as efficient as circumstances seem to demand. Many economists, factory managers, transport workers and other have already pointed out that the problems involving transportation cannot be blamed solely on the transport sector. Problems occur often at shippers' and receivers' sidings, or because of uncoordinated plans between industry and transport. What may be at the bottom of these problems also constitutes the most fundamental difference between East and West: the attitude of enterprises toward transport is indifferent, for it is viewed as a service to be squandered because it costs them so little.

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[12] V. Petrov and V. Yurasov, "Vot takaya arifmetika . . .," Gudok, Oct. 1, 1981, p. 1.

[13] TsSU, "Narodnoe khozyaistvc SSSR v 1980 g.," pp. 336–37 and Ekonomicheskaya gazeta, No. 16, April 1982, p. 1.

IV. TRANSPORT SECTOR INPUT PRODUCTIVITIES

A. FIXED CAPITAL PLANT AND EQUIPMENT

The Soviet transport and communications sector accounts for about 14 percent of the economy's capital stock; long-standing Soviet policy has induced very intensive use of this capital, comparable to the intensive use of housing. Table 10 provides annual estimates for the ruble value of the total capital stock in this sector and of its principal subdivisions. Growth has been steady and quite rapid in the sector as a whole, more rapid than growth in output. Hence capital productivity has been steadily falling in this sector as in most parts of the economy. Putting aside a small communications sector, one sees that the railroads still account for more than half the transport sector's fixed assets. The railroad share of annual investment, however, has been drastically squeezed for the last fifteen or twenty years. Pipeline and maritime shipping, conversely, have been favored. Fragmentary evidence on intentions under the 11th FYP indicate no change in policy, in spite of the difficulties railraods have been facing.

It should be noted that the internal compostion of the aggregate Soviet series for total capital stock is not clear; it probably excludes the value of gathering lines for oil and gas and the value of noncommon carrier trucks. Both have been growing rapidly, accentuating the shift of investment away from the railroads. Scattered evidence on investment plans under the 11th FYP indicates that, although a variety of capital projects are underway to augment railroad capacity, and in spite of current railroad difficulties, their share of total transport fixed assets will continue to decline.

TABLE 10.—YEAR-END CAPITAL STOCKS, U.S.S.R. TRANSPORT AND COMMUNICATIONS SECTOR, 1965–80

[In billions of 1973 rubles]

	Transport and communications	Communications	Transport	Rail transport	Other transport
1965	83.0	6.0	77	43.6	33.4
1966	88.5	6.5	82	45.2	36.8
1967	95.0	7.0	88	46.7	41.3
1968	102.5	7.5	95	48.4	46.6
1969	107.0	8.0	99	50.1	48.9

TABLE 10.—YEAR-END CAPITAL STOCKS, U.S.S.R. TRANSPORT AND COMMUNICATIONS SECTOR, 1965–80—Continued

[In billions of 1973 rubles]

	Transport and communications	Communications	Transport	Rail transport	Other transport
1970	116.0	9.0	107	51.8	55.2
1971	125.0	10.0	115	53.9	61.1
1972	135.0	11.0	124	56.1	67.9
1973	147.0	12.0	135	58.4	76.6
1974	159.0	13.0	146	60.8	85.2
1975	171.0	13.0	158	63.3	94.7
1976	182.0	14.0	168	66.6	101.4
1977	195.0	15.0	180	70.1	109.9
1978	209.0	16.0	193	72.2	120.8
1979	223.0	17.0	206	74.4	131.6
1980	239.0	19.0	220	76.6	143.4

Source: Narkhoz data in 1973 prices for 1975–1980 are split between transport and communications in 1974 proportions. Indexes and ruble data for 1965–74 in 1955 prices are raised by their 1970 overlap. A series for railroads has been compiled from A.V. Izosimov, Osnovnye fondy zheleznogo transporta (Moscow: Transport, 1979) (with the assistance of V. Kontorovich). The nonrail residual is obtained by subtraction.

B. EFFECTIVENESS OF INPUT USE

Table 11 presents a few physical utilization measures to illustrate the intensity with which Soviet transport facilities are used. The density of freight traffic on Soviet railroads, in billions of metric ton-kilometers per kilometer of roadway (first main track) per year, is extraordinarily high.[14] This kind of intensive use is rarely seen elsewhere, certainly not over many thousands of kilometers of interregional main lines. Soviet oil and gas pipelines are also intensively utilized, as the table shows. These high traffic densities spread large fixed costs over a large volume of traffic, bringing net operating costs down. The high traffic densities bring with them a variety of operating problems, however, as physical limits are approached. The issue is developed further in the next section.

TABLE 11.—SELECTED RAILROAD AND PIPELINE UTILIZATION MEASURES, U.S.S.R. BY YEAR, 1965–85

	Rail freight traffic, ton-kms per route km	Oil pipeline traffic, ton-kms per km	Gas pipeline traffic, ton-kms per km
1965	15.1	5.2	1.5
1966	15.3	5.6	1.5
1967	16.3	5.7	1.7
1968	17.1	6.3	2.0
1969	17.7	6.6	1.9
1970	18.5	7.5	2.0
1971	19.5	8.0	2.2
1972	20.4	8.8	2.2
1973	21.7	9.3	2.4
1974	22.6	10.1	2.4
1975	23.5	11.8	2.8
1976	23.8	13.6	3.3
1977	24.0	14.9	3.7

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[14] For historical and comparative perspective, see H. Hunter, "Soviet Transport Experience" (Washington, D.C.: The Brookings Institution, 1968), esp. chap. IV.

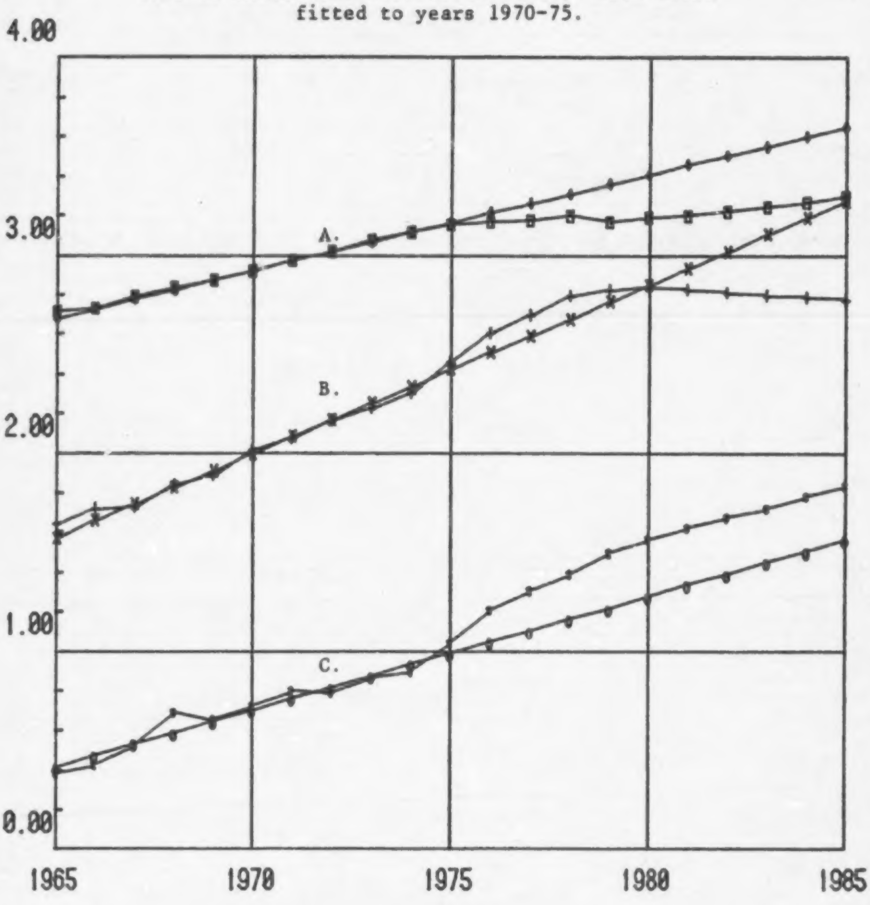
TABLE 11.—SELECTED RAILROAD AND PIPELINE UTILIZATION MEASURES, U.S.S.R. BY YEAR, 1965–85—Continued

	Rail freight traffic, ton-kms per route km	Oil pipeline traffic, ton-kms per km	Gas pipeline traffic, ton-kms per km
1978	24.5	16.5	4.0
1979	23.9	16.9	4.4
1980	24.3	17.2	4.8
1981	24.5	16.9	5.0
1982	25.1	16.7	5.3
1983	25.7	16.5	5.6
1984	26.3	16.3	5.9
1985	27.0	16.1	6.2

Sources: Derived from TsSU Narkhoz data on ton-kilometers and route kilometers. Cf. the NATO paper cited in footnote 1 for underlying data.

CHART 3

Freight Traffic Densities, in ton-kms per km, USSR, By Year, 1965-80 Actual and 1981-85 Intended, with lines fitted to years 1970-75.



A. Log of rail freight traffic density
B. Log of oil pipeline freight traffic density
C. Log of gas pipeline freight traffic density

C. OPERATING LABOR COSTS IN TRANSPORT AND COMMUNICATIONS

Table 12 shows the annual average number of operating workers in the transport and communications sector. This is a fairly skilled labor force, productive and well-paid. It has been growing slowly. Output per worker has improved steadily, except for 1979. While transport labor is regularly exhorted to raise its productivity, there is no indication that labor shortage has been a major problem in the transport and communications sector.

V. POLICY ISSUES

A. THE ECONOMY'S NEED FOR TRANSPORTATION

In an overall sense, the output of the transport and communications sector has kept up with the growth of Soviet GNP since 1965. The upper panel in Chart 4 shows, on a scatter diagram with ratio scales on each axis, how the value of transport-and-communications output has been related to the Soviet GNP in 1970 rubles over the 1965–1981 period. The 17 years lie fairly close to a straight line, without any systematic deviation above or below the line. If the economy were displaying a tendency to use less transport per unit of GNP, successive annual points would lie increasingly below the fitted line. These reconstructed data for the recent past reflect a painstaking effort to measure Soviet structural dimensions using accepted Western methodology. If the 1965–1981 relation between T-and-C output and aggregate GNP were to prevail in 1985, the 11th FYP target for GNP would be associated with T-and-C output of 75.9 billion rubles. Instead, the 11th 5YP target for this sector is only 68.7 billion rubles, indicating a Soviet hope for roughly a 10 percent saving in T-and-C output.

TABLE 12.—AVERAGE ANNUAL OPERATING LABOR FORCE IN THE TRANSPORT AND COMMUNICATIONS SECTOR, U.S.S.R., 1965–80

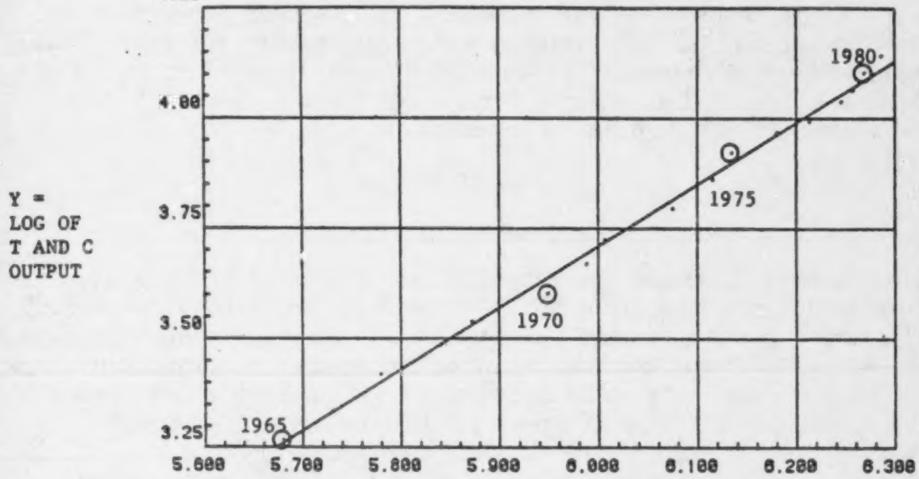
	Rail	Common-carrier truck	Maritime	Internals waterways	Four-carrier subtotal	Total [1] transport and communications
1965	1,981	1,799	89	94	3,963	8,259
1966	1,984	1,805	95	94	3,978	8,437
1967	1,966	1,828	101	94	3,989	8,590
1968	1,968	1,851	107	95	4,021	8,793
1969	1,982	1,875	110	95	4,062	9,072
1970	1,999	1,892	113	95	4,099	9,315
1971	2,015	1,924	118	96	4,153	9,597
1972	2,031	1,962	121	96	4,210	9,881
1973	2,046	2,011	122	97	4,276	10,170
1974	2,059	2,072	126	97	4,354	10,421
1975	2,072	2,128	130	98	4,428	10,473
1976	2,081	2,194	134	99	4,508	10,933
1977	2,090	2,242	137	100	4,569	11,184
1978	2,128	2,298	138	101	4,665	11,462
1979	2,144	2,357	140	102	4,743	11,723
1980	2,190	2,432	143	103	4,868	11,958

[1] The total labor force in transport-and-communications includes those in urban transport and loading-unloading operations, in communications, in air and pipeline transport, and nonoperating labor in the four modes shown above.

Sources: TsSU, various issues of Narkhoz.

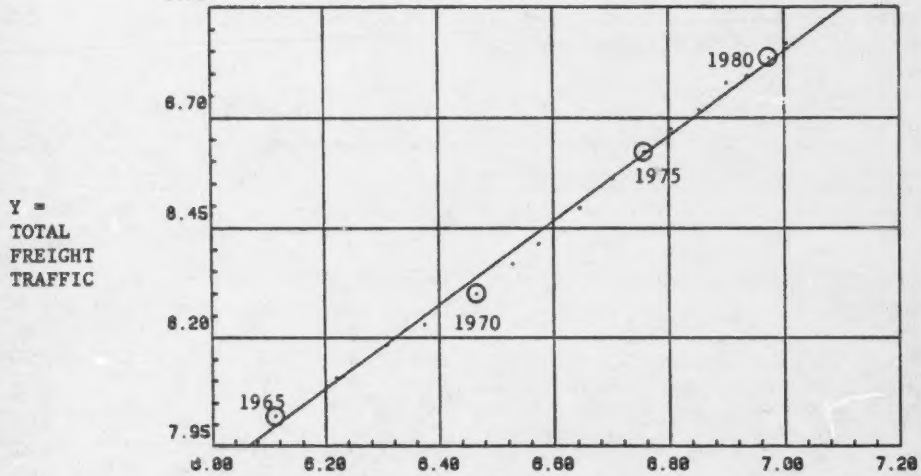
CHART 4

REGRESSION OF T AND C OUTPUT ON GNP, 1965 TO 1981*



X = LOG OF GNP
LOG OF T AND C OUTPUT = -4.69 + 1.40 (log of GNP)
*Source: Revised CIA data, GNP factor cost series, in 1970 rubles

REGRESSION OF TOTAL FREIGHT OUTPUT ON GSP, 1965 TO 1981



X = LOG OF GROSS SOCIAL PRODUCT
LOG OF TOTAL FREIGHT TRAFFIC = 2.14 + .96 (log of GSP)

The lower panel of chart 4 makes a similar comparison, relating the official Soviet series for gross social product in current rubles to a physical series for total ton-kilometers of freight traffic. While the two value series suggest an elasticity of transport demand in relation to GNP that is well above 1.0, this alternative comparison suggests that a 10 percent rise in official Soviet gross social product has been associated over the 1965–1981 period with roughly a 9.6 percent rise in the physical volume of total freight traffic. If the 1965–1981 relation between Soviet gross national product and aggregate ton-kilometers were to prevail over the next four years, the 11th FYP target for gross social product would generate freight traffic totaling 8023 billion ton-kilometers. Here, however, the 1985 traffic targets in the 11th FYP indicate a Soviet expectation that the elasticity of demand for aggregate freight traffic in relation to gross social product will increase, raising total freight traffic up to 8251 billion ton-kilometers, almost 3 percent above its fitted level.

There is thus no evidence of a slackening in demand for transport services. The gross measures reflect many forces at work, including the pull of outlying raw materials tending to increase transport demands, perhaps somewhat offset by the shift of petroleum traffic from railroads to pipelines tending to lower the cost of meeting transport demands. Within the aggregate, moreover, there are specific locations where burgeoning traffic demands are putting great pressure on transport facilities. Soviet practice involves hasty efforts at such points to augment capacity, enough to relieve the pressure, at least for a while.

B. CEILINGS AND SLACK

As we have seen, Soviet railroads since the mid-1970s have found it impossible to keep up the operating gains they had for so long achieved. The performance of motive power, rolling stock, and line facilities, which had steadily improved since World War II, reached a limit or even deteriorated. The evidence suggests that the Soviet railroad system has begun to press against a physical ceiling imposed by existing technology.

The recent work of William Boncher throws vivid light on these matters.[15] Given the present quality of Soviet steel for rails, Soviet locomotive and freightcar designs, and Soviet signaling equipment, exacerbated by chronic shortages of supplies and equipment, Soviet railroads have proved unable to handle additional burdens. Under these conditions, the marginal costs of any shortfall become very high. A failure at one point sends ripples in many directions. Cascading shortages spread from suppliers to railroads to the railroads' customers.

The Soviet economy has been pulled up taut for many years, but until recently, unutilized potential in modern railroad technology was successfully drawn on to "uncover reserves." Now there is evidence in Soviet freight traffic patterns of what is familiar to Western urbanites in passenger traffic: "gridlock". Just as motor vehicles can clog an urban highway system, sending costs of all kinds soaring, a similar phenomenon seems to be appearing in Soviet railroad freight traffic.

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[15] See William H. Boncher, "An Engineering-Economic Analysis of the Utilization and Growth of Freight Capacity of Russian Main Railroad Lines, 1930–1980," June 1892, available from Wharton Econometric Forecasting Associates, Washington, D.C.

Soviet officials and economists are keenly aware of these problems; they are now widely discussed is a variety of Soviet publications. Some writers merely continue to call for efforts to uncover hidden reserves and raise use-factors even higher. Others call for additional investment to augment capacity, implying a shift of investment from some other part of the economy. Very few voices are calling for the deliberate creation of slack at this and many other points in the economy, though a judicious amount of slack in the system would pay for itself in very short order.

As marginal costs begin to rise sharply, before absolute full capacity is reached, cost-minimizing pressures in a market economy force producers to seek relief. Remedies are found before all slack is eliminated, so that the high expenses of over-tautness are averted. The regular availability of spare capacity, far from being wasteful, allows for flexibility and prevents marginal costs from getting out of hand. In the administered Sovet economy, transport agencies and other producers do not find it possible to respond in this way.

C. THE OUTLOOK FOR SOVIET CONTAINMENT OF THE SWITCH FROM RAIL TO ROAD

In developed economies, much of the freight traffic that a generation ago moved by rail is now carried in motor vehicles. Door-to-door speed and convenience have prompted the switch, in spite of its many social costs. The change from railroad to highway for non-bulk freight transport has been deliberately suppressed for three or four decades in the USSR. How much longer should this Soviet policy prevail?

Inter-city freight shipments by truck are most efficient for high-value freight in relatively small consignments and least efficient for mass movement of bulk, low-value commodities. Because of its focus on heavy industry and national defense, the Soviet economy is still generating a below-normal volume of diversified, consumer-oriented output. Even now, however, long distance truck shipments of spare parts and key components for industrial establishments makes good sense, and the volume of such shipments is evidently growing steadily.

In North America and Western Europe, a variety of diversified motor vehicles play a key role in modern efficient agriculture, carrying livestock and perishables to market. As we have seen, the USSR has done little to develop farm-to-market roads so as yet there is little basis for such movement in the USSR. As all-weather roads are built, however, Soviet railroads are likely to lose some of their agricultural freight to trucks, a shift the railroads will not be sorry to see.

The passenger automobile involves even more powerful pressures. In all economies today, developed or not, passenger cars clog city streets and parking is a problem. Long distance passenger travel by rail has almost disappeared in Canada and the United States, while even on the excellent railroad systems of Western Europe and Japan long distance passenger travel faces heavy competition from buses and private passenger cars. Rapid growth of private car ownership has been sweeping from West to East across Europe and is evident in the USSR as well.

Thus, in spite of rising real energy costs, a primitive interregional highway system, and a long tradition of government restraint on personal mobility, there seems little chance that Soviet authorities can hold back the continued drift of passengers from the railroads to other carriers, especially the private automobile. Familiar urban difficulties will result.

THE ROLE OF TERRITORIAL PRODUCTION COMPLEXES IN SOVIET ECONOMIC POLICY

By David S. Kamerling*

CONTENTS

		Page
Summary		242
I.	Introduction	244
II.	The regional dimension of Soviet development policy	245
III.	The TPK concept	247
IV.	Official support for a TPK-centered investment strategy	248
V.	TPKs and the economic environment of the 1980s	253
VI.	Managing the TPKs	255
VII.	The potential for a TPK-centered development policy	257

APPENDIX

TPK Vignettes ... 259

TABLES

1. Changing status of major regional development programs 1971–85 ... 249
2. Potential contributions of a TPK-centered regional development strategy for the solution of major economic problems ... 254
3. Press comments on problems at TPKs ... 258

FIGURE

Territorial production complexes (TPKs) of the 11th five-year plan ... 266

SUMMARY

The Soviet leadership is trying to formalize the role and enhance the status of territorial production complexes (TPKs) in the planning and management of the Soviet economy. Thus far this effort has led to an increase in the responsibilities of the State Planning Committee (Gosplan) for coordinating the development of selected TPKs at the expense of the powerful central ministries. The lack of progress toward the goal of providing TPKs with operating authority, as well as the history of previous reforms, however, suggests that further efforts to implement a TPK-centered investment strategy is meeting stiff opposition. Nor has the increased prominence of TPKs affected traditional problems of poor internal cooperation and inadequate allocation of resources that continue to disrupt development of even high priority projects. Unless these difficulties can be overcome, TPKs are not likely to bring any significant improvement in the operation of the Soviet economy.

TPKs are major regional development projects that are planned and developed as integrated units, bringing together in one area all the related industries and associated infrastructure necessary for

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the production of important natural resources. There are currently eight projects given TPK status in the Eleventh Five-Year Plan (FYP) for 1981–85, most of them focused on the development of energy resources in the eastern areas of the country.

A TPK-centered investment strategy is seen by the leadership as having several advantages at a time when the Soviet economy is growing slowly and new supplies of critical energy and other industrial raw materials are located far from most consumers. TPKs could:

—Ease the growing constraints on Soviet capital and labor through economies of scale.

—Reduce the chronic lack of coordination and cooperation among ministries and local authorities while introducing a measure of decentralized decisionmaking.

—Reduce sectoral and regional conflict over resource allocation through establishment of a hierarchy of officially sanctioned, high priority projects.

Leadership recognition of this potential has been apparent since three TPKs were singled out for priority development in the Five-Year Plan (FYP), for 1971–75. The TPK strategy was given increased status and recognition in the July 1979 planning reform decree, which assigned U.S.S.R. Gosplan the task of planning and managing TPKs without regard to the ministerial affiliation of the enterprises involved. Finally, the 1981–85 plan calls for the creation of a "legal basis" for TPKs—presumably the adoption of statutes that would codify their organizational structure, responsibilities and prerogatives.

As a first step in this process, interdepartmental commissions have been established under both the Council of Ministers and Gosplan to co-ordinate development of the West Siberian TPK with its critical oil and natural gas resources. The effect of these actions has been to strengthen centralized planning and the role of Gosplan at the expense of individual ministries, while at the same time creating an environment for decentralized decisionmaking by locating the Gosplan commission in the TPK at Tyumen'.

The Gosplan Tyumen' Commission is a prototype from which future forms of management may evolve. Although it currently has only advisory authority, its chairman claims that coordination problems have been significantly reduced. A much less positive view of the effectiveness of the commission, however, was provided recently by its deputy chairman, who complained about its lack of adequate influence on the ministries.

Despite the enhanced status being accorded TPKs, they continue to suffer from the same kinds of problems that pervade the Soviet economy—inadequate investment, failure to meet plan targets, low productivity of labor, old plant and equipment, labor shortages and high turnover, poor coordination of production and inadequate attention to social infrastructure. Soviet academics and planning officials have strongly suggested that an important part of the solution to these problems lies in the designation of project managers for the TPKs. The call for the establishment of a legal basis for TPKs found in the 1981–85 Plan clearly indicates that Soviet authorities are moving in that direction. However, even if this effort does give TPKs additional authority beyond that currently held by the

Tyumen' Commission so that they are better able to compete with the central ministries, the history of Soviet regional development policy and other attempts at economic reform would strongly argue against any significant improvement of the chronic problems of inefficiencies in the economy's use of resources. Past experience clearly shows that merely changing the lines of command does not change the basic nature of the command economy, nor correct its deficiencies.

I. INTRODUCTION

As Soviet leaders seek to cope with major economic problems in the 1980s—labor and energy shortages, smaller increments to investment, and declining growth in the productivity of labor and capital—they must come to grips with the increasingly disparate regional concentrations of the nation's resources. In the Eighties nearly all the additional labor will come from Central Asia. At the same time, a much larger proportion of energy and raw material output will originate in Siberia. Meanwhile, European Russia will continue to be the industrial heartland of the USSR, rich in plant and equipment but poor in natural resources and lacking in new labor resources. This geographic dilemma presents Soviet leaders and planners with difficult choices because it fosters conflict over resources among sectoral and regional interest groups at a time when the leadership is striving to shift the economy's growth strategy from simply adding more resources (extensive growth) to better use of existing resources (intensive growth).

An important element of Moscow's growth strategy in the 1980s is to concentrate new capital intensive construction in the less developed eastern regions with their potential for increased supply of critical energy resources and other raw materials, while modernizing outdated and inefficient plant and equipment concentrated in the industrialized areas of the western USSR. This strategy will require large investment allocations at a time when overall investment is growing slowly. Thus Soviet leaders and planners must look for ways to realize economies in the use of investment.

A major roadblock to this goal is the concentration of energy and many raw material resources in Siberia and Northern Kazakhstan and, to a lesser extent, in Central Asia and Southern Kazakhstan, far from the majority of consumers in the west. Most of these resources are located in environmentally harsh, undeveloped areas, characteristics that add substantially to the cost of development. Under these conditions opportunities for realizing savings in investment and production costs through the concentration of economic activities will be an important criterion in allocating investment to these regions.[1] At the same time, a marked slowdown in the growth of productivity and chronic failure to meet plan targets have forced Soviet leaders to look for ways to improve the planning process without making fundamental changes in the economic system. TPKs represent a vehicle through which Soviet planners hope to achieve a better balance between centralized planning of long term, high priority projects, and decentralized decision making that is more responsive to changing conditions at the local level.

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[1] That is by taking advantage of agglomeration economies or economies of scale.

This paper focuses on Soviet efforts to enhance the status of territorial production complexes (TPKs) as a means of decentralizing limited decision making authority while concentrating scarce resources on the most important regional development projects. This paper is divided into three major parts. Section II reviews the role of regional planning in Soviet ideology and the continuing conflict between it and sectoral planning dominated by the central ministries. Sections III and IV discuss the major characteristics of the TPK concept and chart the progress and problems of the increasing official support for their use in Soviet planning. The final three sections present the Soviet view of the benefits to be achieved by implementing a TPK centered development strategy and assess the potential of such a policy for improving the operations of the Soviet economy. Appendix A contains a brief description of the TPKs mentioned in the current five-year plan.

II. The Regional Dimension of Soviet Development Policy

Regional planning has been an integral part of Soviet planning from the inception of national economic planning in the late 1920s. From an ideological perspective, the goal of regional planning historically have been to equalize regional levels of living and development, and to exploit all resources.[2] These goals and measures to implement them have been explicitly included in each succeeding five-year plan. More recently the notion of equalization has given way to the goal of raising levels of living and development in all regions. Although Brezhnev declared the problem of regional inequality solved in 1972, a substantial degree of regional social and economic inequality continues to exist.[3]

The Soviet commitment to regional planning has been evident in the various large-scale regional development programs that have been undertaken and in the Sovnarkhoz (Regional Council) Reform during the Khrushchev years. The history of Soviet development in the eastern regions of the country has been characterized by a series of high cost programs designed to tap vast natural resources and to spur subsequent development based on those resources. A prominent example of this pattern is the industrial development of the Kuznetsk Basin (Kuzbas) in the early 1930s. Development of new major iron and steel centers in the Urals and Siberia was initially based on complementary flows of iron ore eastward from the southern Urals and coal westward from the Kuzbas. Today the Kuzbas is the major industrial center of Siberia with a large, independent iron and steel industry, as well as large machine building and metal-working and chemical sectors. Later examples of this same approach include the Virgin lands scheme of the mid 1950s which opened up million of acres of cropland in West Siberia and Northern Kazakhstan, and construction of the Baikal-Amur Mainline (BAM) Railroad, which is expected to stimulate development of previously inaccessible resources in East Siberia and the Far East when it is finished in the late 1980s.

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[2] For a discussion of the often seemingly contradictory "Marxist-Leninist principles" guiding Soviet industrial location policy see, F. E. Ian Hamilton, "Spatial Dimensions of Soviet Economic Decision Making," in V. N. Bandera and Z. L. Melnyk, eds., "The Soviet Economy in Regional Perspective," New York: Praeger, 1973, pp. 235–260.

[3] Brezhnev's statement on regional inequality appeared in *Pravda*, 22 December 1972, p. 5. For a review of studies of regional inequality in the Soviet Union see, Roland J. Fuchs and George J. Demko, "Geographic Inequality Under Socialism," "Annals of the Association of American Geographers," 69 (June 1979), pp. 304–318.

Traditionally Soviet development policy has had difficulty in reconciling the priorities established under principles of regional planning with elements most important under sectoral or ministerial planning. Regional planning is characterized by a general interest on the part of planners in the development of the entire economy of a region, including the infrastructure needed to support a diversified economy. Ministerial/sectoral planning tends to be much narrower in its focus within a given region. The major concern of the central ministries under sectoral planning is fulfillment of plan targets and the well-being of their own workers. Ministries often provide the infrastructure, support activities and amenities related only to their own activities and employees, while showing little concern for the more general needs of the community in which they are located.

During most of the Soviet period the emphasis has been on planning production along ministerial lines. Regional planning gained ascendency only for a short period during the Sovnarkhoz Reform from the late 1950s to the mid-1960s. This reform, instituted by Khrushchev in response to perceived economic problems associated with "departmentalism" fostered by the ministries, attempted to decentralize planning and management of the economy from the national to the regional scale. The objective was to improve economic efficiency by giving greater consideration to local conditions. It provided regional authorities with substantially enhanced planning and administrative authority over plants in their area. The reform itself was largely a failure, resulting in regional authorities trying to create their own autonomous fiefdoms—the regional equivalent of sectoral departmentalism. In addition, the reform was strongly resisted from the beginning by the still powerful, central bureaucracy, and by 1965 the Sovnarkhoz Reform had been successfully overturned and ministerial planning was in vogue once again.

As the Soviet economy has grown larger and more complex central planners have become less able to cope with the myriad of details involved in planning materials balances over annual and five year periods. Moreover, the current system of planning and management hampers the ability of managers to cope with supply bottlenecks, promotes misallocation of resources, and retards innovation on the factory floor. Although Soviet leaders have been reluctant to make sharp changes in the basic system of central planning, the stringent economic environment of the 1980s and the inability of the current planning system to respond effectively to it, may promote at least modest shifts in the current planning structure.[4] While there are no simple solutions, Soviet planners may be able to ease the effects of some resource constraints by focusing limited available resources on a few selected major regional development programs. Recent developments suggest that territorial production complexes may be one of the primary mechanism for the implementation of such a policy.

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[4] Gertrude E. Schroeder, "The Soviet Economy on a Treadmill of 'Reforms'," "Soviet Economy in a Time of Change," Joint Economic Committee, Congress of the United States, Government Printing Office, Washington, DC, 1979, pp. 312-340. The most recent attempt at reform was initiated with the adoption of a resolution "On Improving Planning and Strengthening the Economic Mechanism's Impact on Raising Production Efficiency and Work Quality," published in Izvestiya and Pravda on 29 July 1979.

III. THE TPK CONCEPT

The concept of a territorial production complex has been extant in Soviet economic and planning literature since its formal introduction by N. N. Kolosovskiy in 1947.[5] Not unexpectedly, Soviet authors have traced the concept's ideological roots to the writings of Marx and Lenin and the early Soviet literature on regional economic planning.[6] Today a vast literature exists on the concept of a TPK.[7] Nonetheless, questions concerning many specific theoretical and practical issues with respect to the nature of TPKs—their scale of operation, the process by which they develop and mature, and identification of different types of TPKs—remain unresolved.[8]

As conceived in the Soviet literature, a TPK consists of a planned set of interrelated industries and associated economic and social infrastructure located within a relatively compact area, and focused on the exploitation of one or more major natural resources. The TPK is dominated by a core of large, growing industries based on these resources. The industrial core determines the economic specialization of the TPK and its role in the national economy. These core industries provide the basis for a set of forward and backward interindustry linkages that tie the region together and generate further growth and development within the TPK. It is not sufficient for a group of economic activities merely to be located in relative proximity to each other; to be characterized as a TPK, all aspects of the region must be planned together to form a unified whole.[9]

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[5] For a translation of the original Kolosovskiy article, see, N. N. Kolosovskiy, "The Territorial-Production Combination (Complex) in Soviet Economic Geography," in George J. Demko and Roland J. Fuchs, eds., "Geographical Perspectives in the Soviet Union" (Columbus, Ohio: Ohio State University Press, 1974), pp. 105–138.

[6] The linkage of TPKs to the earlier periods is made in V. I. Chalov, Voprosy istorii KPSS (March 1979), pp. 43–54; and, N. A. Solov'yev, Sovetskaya rossiya (4 February 1977), p. 2.

[7] An extensive review of the literature on TPKs is contain in O. A. Kibal'chich and M. N. Stepanov, "Problems in the Economic Regionalization of the USSR and the Formation of Territorial Production Complexes," Itogi naukii tekhniki, Seriya Geografiya SSSR, Vol. 15, Moscow, 1979, pp. 66–99. For Western reviews of the concept of a territorial-production complex see, Richard E. Lonsdale, "The Soviet Concept of the Territorial-Production Complex," Slavic Review, 24 (September 1965), pp. 466–478; G. J. R. Linge, Gerald J. Karaska, and F. E. Ian Hamilton, "An Appraisal of the Soviet Concept of the Territorial Production Complex," Soviet Geography: Review and Translation, 19 (December 1978), pp. 681-695; and, George A. Huzinec, "Some Initial Comparisons of Soviet and Western Regional Development Models," Soviet Geography: Review and Translation, 17 (October 1976), pp. 552–65.

[8] Some of the conceptual uncertainty is conveyed in A. Ye. Probst, "Territorial-Production Complexes," Soviet Geography: Review and Translation, 28 (March 1977), pp. 195–203; A. M. Mashkin, "A Typology of Regional Territorial-Production Complexes," Soviet Geography: Review and Translation, 28 (January, 1977), pp. 60–67; A. G. Lis, "On the Question of the Composition of Economic Territorial Complexes," Soviet Geography: Review and Translation, 16 (Janury 1975), pp. 20–27; V. Nikov'skii, "A Typology of Regional Production Complexes," Soviet Geography: Review and Translation, 14 (February 1973), pp. 92–100; and Mark K. Bandman, "Territorial'no-proizvodstvennyye komplekay," Obshchestvennyye nauki (November–December 1979), pp. 68–79.

[9] For a review of the relationship between TPKs and western theories of geographically focused development see, Huzinec, 1976. Alternatively, for a Soviet view of the relevancy of such western theories to the Soviet Union see, A. L. Belov, "Polarized Regional Development: Theoretical Aspects," Soviet Geography: Review and Translation, 31 (November, 1980), pp. 599–603.

Thus, conceptually, TPKs have three important characteristics: a focus on large-scale, high priority, natural resource development projects; a high degree of internal economic, demographic and geographic interdependence; and, a fully coordinated plan for each TPK and all its parts. At a time of increasing national resource constraints and a continuing search for better ways to manage the economy, a TPK-centered investment strategy has several features that make it attractive to Soviet leaders and planners. Such a strategy, in principle could:

1. Address important national problems, especially the need to develop new, distant sources of energy and other raw materials, and establish a hierarchy of regional investment projects, thereby helping to deflect regional contention over resource allocation.
2. Save capital and labor by taking advantage of internal and external economies of scale.
3. Provide a mechanism to coordinate regional development and to resolve conflicts between various combinations of local authorities and participating ministries.

IV. OFFICIAL SUPPORT FOR A TPK-CENTERED INVESTMENT STRATEGY

Widespread support for strengthening regional planning and, more specifically, for having territorial production complexes play an enhanced role in the economy has been building among planners and academics since the early 1970s. In this respect, TPKs have been most strongly promoted through articles and editorials in Planovoye khozyaystvo, the journal of the USSR State Planning Committee (Gosplan); by the Council for the Study of Productive Forces (SOPS) under N. N. Nekrasov within USSR Gosplan, as well as by officials of both the USSR and republican Gosplans generally; and, as part of their overall support for economic development in Siberia, by the Siberian Division of the USSR Academy of Sciences, especially its Institute of the Economics and Organization of Industrial Production headed by Academician A. G. Aganbegyan. These groups and individuals have shown a strong commitment to translating the concept of a territorial production complex into a practical tool for economic planning.

High level political support for the use of TPKs as an important element of national planning was clearly manifested first at the 25th Party Congress in February 1976. In his speech to the Congress, Brezhnev echoed the definition of a TPK when he pointed out the need to improve methods for the integrated solution of large-scale, nationally important, interindustry and regional problems. The responsibility for the management of these problems, according to Brezhnev, should be vested in clearly identified individuals and agencies.[10] Kosygin was even more specific, identifying as one of the top priority tasks for the 1976–80 Plan period the develo-pemnt of a program for the formation of large territorial production complexes.[11] These statements forshadowed the development of a greatly enhanced and more formal role for TPKs that emerged with the Planning Reform decree in 1979.

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[10] Pravda, 25 February 1976, pp. 2–9.

[11] Pravda, 2 March 1976, pp. 2–6.

The first five-year plan to hint at an enhanced role for TPKs was the eighth five-year plan (FYP), 1966–70, which referred to a national economic complex to be created in West Siberia and, specifically to a Bratsk timber industry complex. TPKs received formal official recognition in the Ninth FYP, 1971–75, which called for the further development of the Bratsk and South Tajik TPKs and for beginning the formation of the Sayan TPK (Table 1). It also called for development at the Kursk Magnetic Anomoly (KMA), which was referred to as an industrial complex.

TABLE 1.—CHANGING STATUS OF MAJOR REGIONAL DEVELOPMENT PROGRAMS 1971–85[1]

Project/primary resource and industrial base	Ninth FYP 1971–75	Tenth FYP 1976–80	Eleventh FYP 1981–85
Timan-Pechora/petroleum, natural gas, forest products		Oil/gas province [2]	TPK
Kursk-Magnetic Anomaly/iron ore, steel	Industrial complex	TPK	TPK
West Siberia/petroleum, natural gas, petrochemicals		TPK	TPK
Kansk-Achinsk/coal, electric power		Fuel power compex [2]	TPK
Sayan/hydroelectric power, aluminum	TPK	TPK	TPK
South Yakutia/coal, iron ore		TPK	TPK
Bratsk-Ust-Ilimsk/hydroelectric power aluminum, forest products	TPK	TPK	([2])
Orenburg/natural gas, petrochemicals		Industrial complex [2]	([2])
Mangyshlak/petroleum, natural gas		TPK	([2])
Karatau-Dzhambul/phosphates, chemical fertilizers		TPK	([2])
Pavlodar-Ekibastuz/coal, electric power		TPK	TPK
South Tajik/hydroelectric power, aluminum	TPK	TPK	TPK

[1] There are two major regional development programs that are not TPKs, the Russian Non-Chernozem Zone and the Baikal Amur Railroad. The latter may spawn several TPKs in addition to the South Yakutia TPK already under development.

[2] Identified as a TPK in official maps of the Tenth and Eleventh FYPs.

In the 10th Five-Year Plan, 1976–80, the number of projects specifically designated as TPKs increased threefold (Figure 1). Development of the Bratsk-Ust-Ilimsk, Sayan and South Tajik TPKs was to be continued. In addition, six new TPKs were designated as priority projects: the KMA, West Siberia, South Yakutia, Pavlodar-Ekibastuz, Karatau-Dzhambul and Mangyshlak TPKs. Regional development projects in the Orenburg and Timan-Pechora and Kansk-Achinsk areas that were mentioned in the 1976–80 Plan but not as TPKs, later appeared as TPKs on official maps of basic construction for the Plan.[12] Of the 12 TPKs associated with the 10th FYP, only two were located in the European parts of the country—the KMA and the Timan-Pechora TPKs—and only one, the South Tajik TPK, was in Central Asia.

The 11th FYP, 1981–85, reversed the trend of growth in the number of TPKs included in the "basic guidelines" for the USSR.[13] Four projects—the Mangyshlak, Orenburg, Bratsk-Ust'-Ilimsk and Karatau Dzhambul TPKs—were summarily dropped as TPKs without any explanation. Interestingly, maps depicting regional development projects for the Eleventh FYP do not reflect these changes, although this may only be a matter of cartographic inertia. Bratsk-Ust'-Ilimsk may have been dropped because its development was considered complete. In general, however, these cutbacks probably are related largely to the current squeeze on investment which left Soviet planners little choice but to identify the highest priority national projects and eliminate less promising ones from the published guidelines. Although no new projects were added, the Timan-Pechora, Kansk-Achinsk, and KMA projects were given full status as TPKs within the plan (figure 1).[14]

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[12] Ekonomicheskiy atlas SSSR, Glavnoye upravleniye geodezii i kartografii pri sovete ministrov SSSR, Moscow, 1979, pp. 38–39.

[13] "Basic Guidelines for the Economic and Social Development of the USSR for 1981-85 and for the Period through 1990," Pravda, 5 March 1981, pp. 1–7.

Failure to give a regional development project TPK status in the national plan does not imply that development at the project will stop. On the contrary, these projects may be listed as priority projects in the five-year plans of their own republics. Thus, the Karatau-Dzhambul, Mangyshlak, and Pavlodar-Ekibastuz TPKs are included in the FYP for the Kazakh SSR, even though only the last one is accorded TPK status in the national guidelines.[15] Nonetheless, it seems reasonable that within the hierarchy of development projects, a TPK mentioned in the authoritative guidelines for USSR FYP would have a higher priority, that is, a stronger claim to scarce resources, than one only included at the republic level.

A strong indication that the Soviets were moving toward a greater emphasis on regional planning featuring a TPK-centered investment strategy was provided in a July 1979 planning reform initiated by a joint CPSU Central Committee-USSR Council of Ministers decree "On Improving Planning and Strengthening the Economic Mechanism's Impact on Raising Production Efficiency and Work Quality."[16] A significant aspect of the decree is the emphasis on the "goal/target directed" approach to planning as an important element of national economic planning.[17]

The decree instructed the USSR State Planning Committee (Gosplan) to prepare for incorporation in the next (1981–85) five-year plan a set of comprehensive target programs for the development of individual regions and TPKs. More significantly, Gosplan was given explicit authority to approve the resulting plan indicators and to exercise control over the fulfillment of these plans regardless of the departmental or local affiliation of the individual components involved. Precisely how Gosplan was to "exercise control" beyond its present capabilities was not explained, suggesting that TPKs would remain subject to the same kinds of problems that plague the rest of the economy.

The relatively general instructions in the July 1979 planning decree were formalized later in a set of "Methodological Instructions" on developing target programs to solve regional problems and develop TPKs that were issued by Gosplan in January 1980.[18]

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[14] The Timan-Pechora TPK was included in the draft of the guidelines published in early December as a fuel and power complex. Although this may have simply been an oversight, it seems more likely that supporters of development in the region were able to lobby successfully during the intervening months for the project to be upgraded to TPK status.

[15] Kazakhstanskaya Pravda Feb. 7, 1981, p. 1.

[16] Izvestiya, 29 July 1979, pp. 1–2.

[17] For a discussion of the political and bureaucratic implications of the introduction of the goal/target directed approach to planning see, Paul Cocks, "New Soviet Approaches to Economic Planning and Management," in this volume. A broader, more comprehensive review of the entire spectrum of Soviet attempts at economic reform is contained in Gertrude Schroeder, "Soviet Economic Reform Decrees: More Steps on the Treadmill," also in this volume.

[18] Ekonomicheskaya gazeta, No. 13, March 1980, p. 6.

USSR and republic Gosplans, in coordination with, and with the approval of, their respective Councils of Ministers, were instructed to identify the most important regional problems and prepare plans for their solution. These plans are to be drawn up for the life of the project and are supposed to include (1) justification for the project, (2) a list of sectoral and regional participants and an appropriate administrative structure, (3) a description of the related production and social infrastructure to be developed, (4) a timetable for the project, and (5) estimates of the amounts of different resources required.

The Instructions provide for territorial programs both for revitalizing the economy of developed regions and for bringing into production the natural resources of new territories. Only the KMA TPK, however, is located in the relatively benign environment of the traditional industrialized areas of the European USSR. The remaining TPKs are being created on the basis of the development of resources located in relatively sparsely settled, often remote and inaccessible areas with harsh environments and only the barest of infrastructure to support further development. Specifically, these are the areas where almost all of the critical energy and other natural resources which the Soviets must develop are located.

The 1981–85 Plan provided further evidence that some form of enhanced official role for TPKs is in the wind. According to the Plan, a "legal basis" is to be created for the interdepartmental administration of TPKs. Precisely what is meant by this directive is not clear. Presumably, the enabling statutes would set out the organizational structure, responsibilities, and rights of TPKs, and define these in relation to both existing ministerial and regional authorities. Both of these authorities will resist any intrusion into their areas of competence. Soviet authorities hope, nonetheless, that giving TPKs legal status may help them compete with ministries for increasingly scarce resources.

These two actions—assigning responsibility for planning and overseeing TPKs to USSR Gosplan, and providing TPKs in the near future with legal status—are indicative of the importance the leadership attaches to TPKs. In essence, substantial decision-making authority for the most important regional projects is being concentrated in a single planning agency at the center, Gosplan, while the influence of individual economic ministries on these projects is being reduced. The measures also reflect the tension between the leadership's desire to retain centralized control of the economy and the need to tap the initiative and knowledge of local authorities who are being urged to respond effectively to admonitions for greater productivity.

Brezhnev announced the first step in implementing these moves at the 26th Party Congress in February 1981.[19] After noting that TPKs were to play a growing role in the economy of the Asian regions, Brezhnev indicated that integrated interindustry subunits had been set up in Gosplan to deal with the problem of lack of coordination among ministries participating in TPK developments. In particular, Brezhnev said that both a USSR Council of Ministers' Commission and a Gosplan commission located at Tyumen' had been established for the West Siberia TPK. The two committees were subsequently identified as the USSR Gosplan Interdepartmental/Interagency Regional Commission on Questions of the Development of the West Siberian Oil and Gas Complex, headed by V. Kuramin, and the Commission of the USSR Council of Ministers Presidium on Questions of Developing the West Siberian Oil and Gas Complex, headed by deputy chairman of the USSR Council of Ministers, V. Dymshits.[20]

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[19] Pravda, 24 February 1981

This is the first time that a USSR Gosplan subdivision has been established outside Moscow.[21] According to Kuramin, the membership of the Tyumen' based group includes representatives of large production associations, science research centers, regional goverment and party organizations, and USSR and RSFSR Gosplans. The authority of the Commission, as it was initially constituted, consisted of convening conferences and submitting recommendations both to USSR Gosplan and directly to the Council of Ministers Commission on West Siberia. By early 1982, Kuramin claimed that the Tyumen' based Commission was having considerable success in resolving both long-term and day-to-day problems of coordination and planning between ministries and called for even further expansion of its responsibilities. Under Kuramin's leadership, the Commission apparently already had increased its oversight responsibilities from four to five coordinating departments and now was seeking to add at least four more. In addition, Kuramin indicated that the West Siberian TPK had been expanded to include not only Tyumen' and Tomsk oblasts with their oil and gas reserves, but also Novosibirsk Oblast with its large scientific research establishment.

This rather rosy view must be balanced against the comments of the deputy chairman of the Gosplan Commission, T. K. Alpatov.[22] Although Alpatov agrees that the Commission is having some degree of success, he also indicates that difficulties remain. Part of the problem lies with the Gosplan statute governing the Commission which apparently does not clearly identify the physical boundaries of the complex and its areas of responsibility. In particular, because, the Commission is strongly focused on the development of oil and gas resources, the question has arisen as to whether the Commission has responsibilities in those aspects of the West Siberian TPK not directly involved in the oil and gas complex.

Alpatov also complains about the awkwardness of the mechanism for submitting suggestions, all of which now must go first to USSR Gosplan. He would like to see the process short-circuited so that the Tyumen' Commission can deal directly with the ministries on routine matters, reserving the channel through Gosplan for important decisions requiring approval by Gosplan or the USSR

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[20] Very little is currently known about the Council of Ministers Commission. The Commission met, probably for the first time, in Tyumen' Oblast from 25-27 March 1981, to acquaint itself with the situation in the region and to map out its program. Dymshits, who has a long history of involvement in energy related matters, was identified as the head of the Commission at that time. Ekonomicheskaya gazeta, No. 14 (April 1981), p. 6.

[21] The following discussion of the Gosplan commission is based on an interview with Kuramin published in Sotsialisticheskaya industriya, 19 June 1981, p. 1; and, two articles by Kuramin published in early 1982: Ekonomicheskaya gazeta, No. 3, January 1982, p. 15; and, Pravda, 3 March 1982, p. 2.

[22] Planovoye khozyaystvo, (May 1982), pp. 114-120.

Council of Ministries. This view is echoed by Kochetkov, who praises the creation of the two commissions as a progressive step but one that is not necessarily applicable to other TPKs. He suggests that they will only complicate management by adding another bureaucratic step to the decisionmaking process. Kochetkov proposes giving future interdepartmental coordinating bodies direct authority over activities in the TPK.[23] Finally, Alpatov alludes to a problem common throughout the Soviet economy: responsible ministries often respond only partially or not at all to plan targets, much less to simple suggestions from other authorities, when it is in their own interests to ignore them. In essence, these authors are arguing that without additional authority the Tyumen' Commission and any similar ones created in the future will be hard pressed to force implementation of proposals which the ministries do not like.

Despite the problems, Kuramin clearly sees the Commission as a prototype for a new form of project manager that would allow a needed degree of decentralization of supervision while retaining centralized control. If the Tyumen' Commission continues to experience success, it is likely that similar bodies will be created for other TPKs. In line with the directives of the 1981-85 Plan, Kuramin has indicated that he anticipates measures to increase the Commission's legal authority. Such a move will be strongly resisted, no doubt, by the central ministries who stand to lose some of their own authority.

V. TPKs AND THE ECONOMIC ENVIRONMENT OF THE 1980s

The development of the new fuel and energy resources located in the eastern regions of the country is one of the highest priority items on the Soviet economic agenda for the 1980s. Obtaining these resources will be difficult and costly. At the same time, with increases in capital and labor resources becoming progressively smaller, Soviet leaders apparently believe that a TPK-centered investment strategy offers important advantages for the development of these remote energy resources (Table 2). Thus a natural concordance exists between the implementation of a TPK-centered investment strategy, and the need to develop high-priority, energy related projects such as the Timan-Pechora and West Siberia oil and gas fields, the Ekibastuz-Pavlodar and Kansk-Achinsk coal deposits, and to a lesser extent, the Sayan and South Tajik hydroelectric stations. In the short term, the Soviets have little choice but to concentrate scare investment resources on the development of these energy resources. The recent call to provide TPKs with legal status and the moves to concentrate overall authority for their growth and development in USSR Gosplan rather than in ministerial and local authorities, are reflections of the severity of the economic and administrative problems that plague the Soviet economy, coupled with the hope that a formal TPK policy will yield greater efficiencies than an informal one.

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[23] A. Kochetkov, Pravda, 16 March 1982.

TABLE 2.—POTENTIAL CONTRIBUTIONS OF A TPK-CENTERED REGIONAL INVESTMENT STRATEGY FOR THE SOLUTION OF MAJOR ECONOMIC PROBLEMS

Economic problem	Possible contribution of TPKs
Slowdown in growth of the economy and of capital investment	Reduce demand for capital investment through external and internal economies of scale; stimulate the economy by making full use of forward and backward linkages; concentrate investment on priority projects and labor productivity.
Slowdown in growth of labor force and labor productivity; change in the geographical origins of majority of the new entrants to labor force.	Reduce demand for labor by concentrating capital intensive investment in remote regions; focus labor intensive investment in areas with a labor surplus; diversify industrial structure to provide employment opportunities for all elements of the labor force.
Declining natural resource base in European USSR	Focus investment on natural resources in the eastern regions, especially fuel and energy resources; reduce transportation costs by preliminary processing of raw materials and producing locally equipment needed within the region.
Backlog in unfinished construction	Concentrate new construction in TPKs.
Bureaucratic management system	Project manager to cut through red tape and bureaucratic inertia and infighting.

Soviet planners expect the geographical concentration within TPKs of investment in production facilities and infrastructure to achieve significant economic efficiencies in the utilization of resources by taking advantage of external and internal scale economies resulting from the closely inter-woven network of linkages inherent to TPKs. Aganbegyan estimates that developing industries, resources, and infrastructure in a TPK framework would result in a savings of 15-20 percent of total capital investment compared with a more dispersed location policy.[24] Probst claims that the savings in infrastructure costs alone from organizing development in TPKs would run 25 to 30 percent on the average.[25] Probst also stresses the efficiencies in resource utilization associated with TPKs. He points out, for example, that forward and backward linkages among production units are expected to operate even to the extent that waste material from one enterprise becomes an input to another. Similarly, under the TPK concept, regional design bureaus, construction and repair facilities, and general supply and service support organizations should be centralized and established on a larger scale, thereby increasing efficiency and reducing costs. The same benefits would result from the joint use of social infrastructure (medical services, education, transportation and communications, utilities). Probst also sees benefits from the use of TPKs for the management of labor resources. With the growth of the labor force slowing, demand for labor in TPKs would be reduced by using large scale, highly mechanized, capital intensive, up-to-date production technologies. Finally, because TPKs are supposed to contain a variety of heavy, light and services industries that tap different segments of the labor force, they would be able to make full use of labor resources.

The economies resulting from the successful implementation of a TPK-centered investment strategy could be quite significant given the estimated cost of the current list of TPKs. For example, the cost of development at the Pavlodar-Ekibastuz TPK has been estimated at nearly 8 billion rubles.[26] Investment in the South Yakutia TPK is expected to approach at least 2 billion rubles.[27] Investment in the Kansk-Achinsk TPK is estimated at 5–6 billion rubles for industrial construction and 1.2 billion rubles for municipal construction.[28] Significant savings on investments that are on the order of those envisioned by Aganbegyan and Probst in projects of this magnitude would be very attractive to Soviet leaders.

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[24] A. Aganbegyan, Zhurnalist, No. 7 (July 1978), p. 12-15.

[25] A. Ye. Probst, "Territorial Production Complexes," Soviet Geography: Review and Translation, 28 (March 1977), pp. 195-203.

The current squeeze on investment, however, ensures that sufficient funds for comprehensive development of TPKs will not be available in the future any more than they have been in the past. The development that has taken place in TPKs so far has emphasized construction of the core industries while giving relatively little attention to the development of infrastructure and ancillary industries. Yet, as suggested above, even this meager development of the current set of TPKs requires very large amounts of capital. It seems likely that this limited development pattern will continue so long as investment resources continue to grow slowly.

The demand for investment in major energy projects located primarily in Siberia also comes at a time when the older industrialized regions of the European USSR—especially the central industrial region centered on Moscow, the Ukrainian industrial region centered on the Krivoy Rog and Donets Basin, and the industrial zone of the Ural Mountains between Serov and Magnitogorsk—are seeking substantial funds to modernize existing plant and equipment. Modernization is generally seen as a less costly and less time consuming alternative to new construction for increasing industrial production and productivity. The regional investment strategy outlined in the current five-year plan stresses investment for modernization in the European areas while concentrating new construction in capital intensive projects in the east. This policy is designed both to ease demand for investment and to reduce the backlog of unfinished construction. The competition for investment between these two macro regions—the relatively undeveloped east and the more industrialized west—could well intensify during the coming decade if investment continues to grow slowly as expected.[29] Should the Central Asian republics enter the competition for capital more energetically in the near future, basing their demands for a larger share on the needs of their rapidly growing populations, the potential for conflict would become even more severe.

VI. MANAGING THE TPKs

Soviet planners and economists have been virtually unanimous in supporting the idea of project managers for TPKs. In the past, one of the ministries charged with developing the core industries usually achieved a large degree of prominence and, by default, exercised leadership in the TPK. Under this format, however, TPKs remain subject to the same kinds of interministerial lack of coordination and conflicts that affect the entire Soviet economy. The Soviet press contains many references to shortages of funds, materials, and labor at these supposedly high priority development projects. Similarly, there are complaints in the press of a lack of cooperation betwen ministries and local authorities. Problems may also arise when a TPK includes more than one regional administrative unit. Thus, Bandman and Malinovskaya point out that in the Sayan TPK, government and party authorities of the Khakass Autonomous Oblast fail to coordinate the development on their own territory with authorities in a group of rayons across the Yenisey that are subordinate to Krasnoyarsk Kray.[30]

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[26] Izvestiya, 20 June 1980, p. 2.

[27] Trud, 27 July 1980, p. 2.

[28] L. G. Sizov, Ugol, June 1978, pp. 9–12.

[29] For a discussion of the East-West Debate, see Leslie Dienes, "Investment Priorities in Soviet Regions," Annals of the Association of American Geographers, 62 (September 1972), pp. 437–454; and David A. Drach, "Tapping the Energy Wealth of Siberia: A Case Study of the Kansk-Achinsk Coal Basin," Discussion Paper No. 51, Department of Geography, Syracuse University, Syracuse, NY (July 1978), pp. 8–20.

The poor coordination and lack of cooperation so typical of the Soviet economy in general and TPKs in particular often leads to duplication of effort, inefficiency, and waste. Thus, each ministry participating in the development of a TPK might build housing for its own workers and provide them with limited related social infrastructure. But these facilities would not necessarily be integrated with similar neighboring residential units put up by other ministries. Development of such facilities probably would be done more effectively if the resources of the participants were pooled. A different kind of problem results from the failure by any one participant in a TPK to meet its plans on time, thereby throwing the planned development of the entire TPK out of sequence. In some cases transportation links either are not ready when they are needed or are in place well in advance and lie relatively unused. In other cases, the network of forward and backward linkages critical to integrated development of a TPK can be badly disrupted when construction of one plant, especially a large one, in the network is not completed on time. Finally, ministries have simply decided unilaterally not to build an enterprise that was to be an integral part of a TPK.

Soviet writers argue that planning and developing TPKs as integrated projects, each under the control of a single project manager with full decision-making authority, offers many opportunities to resolve or at least ameliorate some of the problems commonly associated with the bureaucratic Soviet system. A strong project manager would have a clear view of the many linkages among the elements of a TPK and would be able to allocate resources so as to reenforce interdependence among its parts, and foster a greater degree of cooperation and coordination within the TPK between the various sectoral and regional participants. To facilitate this development, Annenkov stresses the importance of planning and financing each TPK as a single line item in the plan and the budget.[31] In order to be effective, however, these measures need to be accompanied by enough political clout to obtain necessary resources from the center, and by adequate authority to obtain ministerial compliance for decisions related to matters within the TPK.

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[30] M. K. Bandman and M. A. Malinovskaya, "Iyvestiya Sibirskoyo Otdeleniya Akademii Nauk SSSR, Seriya Obshchestvennykh Nauk," May 1979, pp. 9–14.

[31] B. N. Annekov, "Finansovye aspeckty formirovaniya i razvitiya territorial"no-proizvodstvennykh kompleksov," Finansy SSSR, September 1980, pp. 19–24.

Under the July 1979 planning decree, it appears that Gosplan is being given primary responsibility for guiding the comprehensive development of TPKs. There seems little question, however, that the central ministries will struggle to retain their economic decision-making prerogatives and will not relinquish them willingly to Gosplan. Based on previous Soviet attempts at administrative reform, any attempt to fully implement a TPK-centered development strategy with a strong project manager probably would be undermined and greatly diluted by vested bureaucratic interests as is already occurring in the West Siberia TPK.

VII. The Potential for a TPK-Centered Development Policy

The current list of TPKs illustrates the advantages and problems the Soviet leadership will encounter as it tries to implement a TPK-centered regional investment strategy. Each of these projects satisfies the first characteristic of a TPK: they are all long-term, large-scale projects of national significance. Most of them directly address the fundamental regional development problem facing the USSR today—the concentration of future supplies of most raw materials, especially fuel and energy resources, in remote eastern regions, separated by great distances from the bulk of the existing industrial base, population and socioeconomic infrastructure in the western areas of the country. Under this strategy, critical fuel and energy resources located in the eastern regions are being opened up for exploitation. Completion of the BAM sometime in the late 1980s will provide access to important new resources some of which may form the basis for new TPKs. The most obvious candidate for TPK status is the Udokan copper deposit.

The potential for a successful TPK-centered development policy is reduced, however, by Soviet inability to make effective use of the two other basic characteristics of TPKs. Specifically, many of the anticipated economic benefits inherent in the TPK concept stem from the idea that they should be planned as individual entities, and internal economic and social units should exhibit a maximum degree of economic, technologic and geographic interdependence. Many of the problems found within TPKs, however, derive directly from the conflict between these two conceptual characteristics and the everyday reality of the Soviet economic system. The inability of Gosplan to assure adequate resources for important projects, the long history of bureacratic resistance to economic reforms, interministerial conflict and lack of cooperation over the allocation of scarce resources, and the consistent failure of responsible ministries and local authorities to provide adequate social infrastructure are all problems endemic to the Soviet system that work against successful implementation of a TPK strategy (Table 3). The slowdown in the growth of the economy and capital investment, and a conservative leadership apparently unwilling to make significant structural reforms which might alleviate some of these problems loom as further obstacles to implementation of the TPK concept.

TABLE 3.—*Soviet press comments on problems at TPK's*

Pavlodar-Ekibastuz TPK: Coal industry is criticized for failure to prepare plans on time (sotialisticheskaya industriya, 15 July 1980, p. 2); Furthermore, mine construction is lagging so badly due to insufficient construction capacity that the construction combine in charge has not utilized even one-tenth of the funds alloted (Izvestiya, 20 June 1980, p. 2).

Karatau-Dzhambul TPK: Construction of needed housing and cultural facilities is proceeding too slowly (Ekonomicheskaya gazeta, 20 May 1978, pp. 1–2); There is a shortage of at least 7,000 workers and the vocational-technical school which was to supply workers will not open until 1980 with its first graduates available only three years later (Tekhnika i nauka, 8, August 1977, pp. 2–5).

Mangyshlak TPK: There exists a persistent shortage of skilled workers, a decline in production efficiency, and a high rate of labor turnover due to lack of decent housing and facilities (Pravda, 28 October 1979, p. 2).

South Tadzhik TPK: Construction of a few large enterprises and major hydroelectric plants does not contribute to effective utilization of the region's growing labor resources. Nonetheless, there is a chronic shortage of manpower, (Izvestiya aokademii nauk Tadzhikskoy SSR, Otdeleniye obshchestvennykh nauk, March 1979, pp. 41–46); Bottlenecks and lack of coordination in development of the TPK will continue until an overall plan for the formation of the complex, a uniform system of financing and material and technical supply, and a special agency to direct such a plan and system are created. (Pravda, 4 August 1979, p. 2); USSR Ministry of Nonferrous Metallurgy annually allocates only half as much capital to housing construction as is required (Stroitel'naya gazeta, 10 January 1979, p. 2).

South Yakutia TPK: An acute shortage of manpower exists. The lack of coordination requires a single unified TPK development management agency above ministry level which could go directly to USSR Gosplan or the USSR Council of Ministers (Trud, 27 July 1980, p. 2).

West Siberia TPK: This region suffers from a chronic shortage of manpower, transportation linkages, and social infrastructure, and needs improved management structures (Sotsialisticheskaya industriya, 1 July 1980, p. 2; Stroitel'stvo trudoprovodov, April 1980, pp. 22–24; Pravda, 17 May 1979, p. 2).

Kansk-Achinsk Fuel Power Complex: There are many problems in the construction of housing and transportation facilities (Trud, 27 June 1980, p. 2.), plus inadequate financing and lack of coordination in construction (Sovetskaya rossiya, 1 November 1979, pp. 1–2).

These problems, and in particular the current squeeze on investment, probably mean that in most TPKs only limited development of the most essential facilities will take place during the 1981–85 Plan period. There simply will not be adequate resources available to provide for the kind of comprehensive development that might produce substantial savings in the long run. In addition, if TPKs evolve into politically viable, independent entities, they might easily add to the investment problem by competing among themselves for already limited resources.

The West Siberia TPK will be allocated the lion's share of the increment to investment for the production of oil and natural gas which is absolutely essential to the Soviet economy. This TPK, however, is much too large and its environment too harsh to serve as a focus for diversified development. Several other energy related TPKs also will undergo limited development. The Kansk-Achinsk and Pavlodar-Ekibastuz TPKs are being counted on to supply large amounts of stripmined coal and electric power from coal-fired thermal plants to other regions of the country to help ease the nation's energy problems. The successful exploitation of the energy resources of these two TPKs will be hindered by the current lack of a proven technology for efficiently transmitting electricity over the long distances involved, and by the inability of the already overburdened rail system to move the amounts of coal required if the transmission problem cannot be solved. Development of coal resources at the South Yakutia TPK will continue but its national importance results from its ability to earn needed foreign exchange rather than in the area of energy production except, perhaps, within the Far East. Finally, the Timan-Pechora TPK will receive considerable attention because, even though its oil and natural gas reserves are small compared to those of West Siberia, they are located much closer to the main centers of energy demand.

The major focus for truly diversified development is likely to be the Sayan TPK. It is located in one of the more environmentally benign areas of Asiatic Russia. The region possesses good supplies of coal and other minerals and has a relatively well developed transportation network. The Soviets have already made a substantial commitment to development of the region beyond the basic industries—a hydroelectric power plant and associated aluminum refinery—which define the core of the region. A railroad car plant is under construction at Abakan and several plants of the electrical equipment industry are planned at Minusinsk.

Soviet leaders, therefore, are faced with what is in all probability an insolvable dilemma. They perceive that a TPK-centered regional development strategy offers many potential economic benefits, but their ability to take advantage of such a policy is greatly circumscribed by the powerful interests of the existing planning and management system and by the major economic and geographic constraints they currently face. The July 1979 planning decree and the creation of the two interdepartmental commissions make clear that the Soviets are trying to institute some form of TPK-centered development strategy under the aegis of Gosplan. But, it has been over a year since the objective of creating a legal basis for TPKs was first expounded in the Draft Directives for the Eleventh FYP and there is still no indication of what the result of this effort will be. In fact, the lack of comment in the press suggests that resolving this issue is turning out to be very difficult. Whatever its form, this new entity will require time to develop its operational capabilities, and as it does so it is likely to offend both the ministries and regional governments. Whether this new "authority" will be successful, and to what degree, or whether it will only result in another layer on the bureaucracy, emasculated by powerful ministries and economic forces beyond its control, is a question whose answer will not be known for several years. The history of the Soviet economic system, however, weighs in favor of the latter.

APPENDIX

The appendix provides a brief overview of the 8 TPKs being developed during the 11th FYP (Figure 1). Each individual vignette describes the natural resource and industrial core of the TPK and provides a brief assessment of its role in the USSR economy. When possible, the anticipated investment costs are included.

West Siberia TPK.—This is a vast TPK, spread out over much of Tyumen', Tomsk and now perhaps, part of Novosibirsk Oblasts. Its critical oil and gas resources are located in the more remote northern regions of the TPK, in areas of harsh environment, limited transportation facilities, sparse population and virtually no social infrastructure outside of a few small urban centers. The West Siberia TPK will develop an integrated and diversified industrial structure only to a limited extent in the more hospitable narrow southern zone along the Transsiberian Railroad. It would be difficult, however, to overstate the importance of this region to the Soviet economy. It contains the critically important oil and gas reserves from which the Soviets will obtain an ever-increasing proportion of their production. The cost of obtaining these resources has been and will continue to be enormous. Investment in the development of West Siberian oil and natural gas was more than 25 billion rubles during 1976–80 alone.[1] This was nearly 4 percent of total USSR investment for the period. The Soviets have had to resort to a variety of methods to secure labor for the region, including bringing crews in for short rotations from far outside the region. In addition to extraction of oil and gas, the Soviets are building major petrochemical plants at Tomsk and Tobolsk and are developing Surgut as the main support center for the oil and gas fields. Surgut was linked by rail to the Transsiberian Railroad at Tyumen' in 1973 and an extension to the gas fields at Urengoy is nearly complete. A major electric power plant using associated gas from Samotlar also has been built there.

Timan-Pechora TPK.—Located in the Komi ASSR in northern European Russia, the Timan-Pechora TPK is one of the two TPKs located west of the Ural Mountains. In terms of environment, population and level of development, however, it resembles the West Siberia TPK with which it shares a common boundary. Like West Siberia, the development of this TPK is based on energy resources. In addition to oil and natural gas, the region also contains important reserves of coal at Vorkuta. About half of the coal produced is suitable for coking. The importance of the region in oil and gas production has been growing. During the 1976–80 plan period, Komineft (Komi Autonomous Republic Petroleum Association) increased petroleum production by fifty percent (still only slightly more than 3 percent of Soviet production) and moved from 16th to 5th place in the absolute volume of production.[2] The volume of gas production has also grown, although the region's share of production has declined as West Siberia's production expanded. The TPK has significant timber reserves and an important forest products complex has developed at Syktyvkar which also serves as the main support and supply center of the region. Exploitation of potentially important titanium and bauxite deposits remains in the planning stage. The value of the resources of the Timan-Pechora TPK is increased substantially by its proximity to the European part of the USSR. Apparently a Russian Republic Commission for Coordinating Questions Involving the Formation of the Timan-Pechora Territorial-Production Complex existed at one time although its ability to direct the development of the TPK is not known.[3] Investment in the Timan-Pechora TPK during the Eleventh FYP is expected to exceed 7 billion rubles.[4]

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[1] A. Aganbegyan, Liturnaya gazeta, 7 November 1979, p. 11.
[2] Pravda, 1 September 1980, p. 2.
[3] Pravda, 1 April 1977, p. 3.
[4] I. Movozov, "Sotsialisticheskaya industriya," 9 May 81, p. 2.

South Yakutia TPK.—The South Yakutia TPK, the first and so far the only TPK in the BAM zone, has a distinct orientation towards the Pacific. It is currently being developed as part of a long-term compensation agreement initiated in 1974. Under the agreement, Japan will provide the Soviet Union with credits worth $450 million for purchase of equipment and some consumer goods. In return it received the right to purchase 104 million metric tons of coking coal during 1983-1999. An additional $90 million in loans has been granted subsequently.[5] Total cost for development of the South Yakutia TPK has been estimated at $16 billion.[6] According to Soviet accounts, approximately 700 million rubles were spent on development in the TPK during 1976-80 and an additional one billion rubles were needed during the next 2½ years.[7] Assimilation of these funds has been very slow—only half of the investment planned for 1979 was actually accomplished—and living conditions remain very poor. It seems unlikely that production of coking coal from Neryungri will meet the level required by 1983, forcing the Soviets to rely on Kuznetsk coal to meet their export obligations. Future development will almost certainly include the large iron ore deposits near Aldan, and probably other nearby mineral deposits. It is likely that much of the region's new mineral production will be used, at least initially, for export where it will be able to earn valuable hard currency. The TPK has been linked to the Transsiberian Railroad and the Pacific coast since completion of the Little BAM railroad in 1978.

South Tajik TPK.—The South Tajik TPK covers over one-third of the territory of the Tajik Republic and contains nearly two-thirds of the republic's population, including the capital of Dushanbe. The core of the TPK is hydroelectric power from the Vakhsh River. The Nurek hydroelectric power plant with a capacity of 2.7 million Kw has been completed, and construction has begun on the Rogun power plant upstream which will have an even larger capacity of 3.6 million Kw. Construction of the two large energy intensive plants associated with the TPK—an aluminum plant at Tursunzade and an electrochemical plant at Yavan based on locally mined minerals—has been extremely slow (over 15 years so far). Although parts of the plants are in operation, they are still far from complete.

The reason for the sluggish development, according to a Tajik republic Gosplan official, is the failure of the responsible central ministries to allocate sufficient funds.[8] Furthermore, the funds that have been provided have gone to industrial construction; housing and other infrastructure development lag far behind current requirements. The slow pace of industrial development has left the region with substantial excess electric power capacity. The dams are also expected to stimulate agriculture, especially cotton production, by providing water for irrigation. Although this TPK is located in Central Asia with its rapidly growing population, labor shortages have been common because most of the local labor force is not adequately trained for the types of jobs being created. In addition, there have been complaints that not enough attention is being paid to expansion of the more labor intensive industries such as textiles that are already established in the region and which could absorb some of this unemployed or underemployed labor force.

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[5] Richard L. Edmonds, Siberian Resource Development and the Japanese Economy: The Japanese Perspective, Discussion Paper No. 12, Association of American Geographers Project on Soviet Natural Resources in the World Economy, Washington, D.C., August 1979, pp. 9-10.

[6] Mining Journal, 21 September 1979, p. 244.

[7] Trud, 27 July 1980, p. 2.

[8] Ye. Akimov, Stroitel' naya gazeta, 10 January 1979, p. 2.

Kansk-Achinsk TPK.—The Kansk-Achinsk Fuel and Power Complex (KATEK) is based on the development of massive deposits of relatively low-grade coal spread out over 60,000 square kilometers along 800 kilometers of the Transsiberian Railroad in East Siberia. Most of the coal lies in thick horizontal seams that is suitable for stripmining. Party and government decrees for the development of KATEK were issued in March 1979, but the region will begin to make a significant contribution to Soviet energy production only after 1990. Annual production from old mines undergoing reconstruction and new mines being opened was about 35 million tons in 1980. Output will approach 50 million tons by 1985, with final production capacity expected to reach 7–8 times that amount. The first of 8–10 large (6,400 MW), mine-mouth, thermal electric power plants projected for the coal basin is slowly being built. The projected cost for development of the Kansk-Achinsk TPK was estimated at 5–6 billion rubles for industrial construction, and an additional 1.2 billion rubles in municipal construction.[9]

The potential for KATEK coals to contribute directly to satisfying energy demand by consumers in the western USSR is sharply limited by their inability to withstand long distance hauls without preliminary processing. The coals have a high moisture content, are very friable and are given to spontaneous combustion. In addition, the technology for the direct current, high voltage, 1500 Kv long distance transmission lines that Soviet planners envision to carry electricity westward is still undeveloped. Moreover, the railroad system would be unable to handle the greatly increased volume of freight required should the technology for transmission not be available. For the foreseeable future, therefore, KATEK energy production will be used mainly in Siberia. Another possible use of KATEK coals that is being given support is the production of synthetic liquid fuels, but the conversion technology required remains uncertain.[10] The major industrial center of the TPK is Krasnoyarsk, a city of over one million inhabitants with a large established industrial base. The only major new manufacturing facility currently planned for the Kansk-Achinsk TPK, a plant to manufacture the large shovels and excavators needed for strip mining operations in KATEK, is located there.

Pavlodar-Ekibastuz TPK.—The key element in this TPK is the Ekibastuz Fuel and Power Complex (ETEK). Its development and high-priority status was confirmed in a joint CPSU Central Committee-USSR Council of Ministers Decree in 1977. Development of ETEK is based on large deposits of low quality bituminous coals with a relatively low caloric value and high ash content. Reserves are estimated at over 7 billion tons, and much of the coal is suitable for stripmining. The Bogatyr' strip mine is the "star" of the complex, with production now approaching 50 million tons per year from a base of 100,000 tons in 1970. Coal extraction costs in this mine are just over one ruble per ton—less than one-third of the cost of other open-pit mines.[11] Output from the entire complex, which now produces about 70 million tons, is scheduled to reach 84 million tons by 1985 and have an ultimate capacity of more than 150 million tons.

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[9] Ugol', January 1978, pp. 9–12.

[10] Sheyndlin and I. Kalechits, Izvestiya, 24 April 1981, p. 2.

The Soviets plan to use this capacity to generate a significant proportion of their electricity requirements. As of 1981, Ekibastuz coal fueled 20 power stations in the Urals, Siberia and Kazakhstan with a total capacity of over 12 million kw.[12] The overall planned capacity of power stations using ETEK coal is 36–38 million kw. Most of the increased capacity will come from four, 4 million kw power plants to be built near Ekibastuz using the same basic designs. Construction of the first of these plants is in progress while construction of the second is just beginning. Ekibastuz coals cannot stand the cost of transportation beyond the Urals because of their high ash content, and, even if they could, the increased burden would probably be too great for the already strained railroad system to handle. The Soviets, therefore, plan to feed electricity to the power grids of the European USSR and especially to the Ural industrial zone through a system of long distance, high tension transmission lines. The centerpiece of this scheme is a 1,500 Kv direct current line. As noted earlier for Kansk-Achinsk, the technology for this type of line is still being developed. The Soviets are much further along in the development of technology for a 1,150 Kv standard alternating current line which also is to be built.

The Pavlodar-Ekibastuz TPK has been under development since the early 1970s. About 2 billion rubles were invested between 1971–75,[13] and total investment over the 20–25 years the Soviets expect it will take to develop ETEK completely is pegged at 7.6–8.0 billion rubles, or three quarters of the estimated cost of the BAM railroad.[14] Interestingly, one of the major problems experienced at the TPK is the inability to efficiently absorb all the available investment due to lack of construction personnel and equipment.[15] Other important construction projects at the TPK are the Pavlodar Alumina Plant, the Yermak Ferroalloy Plant, and expansion of the Pavlodar Tractor Plant. In addition, the railroad lines serving the area and associated facilities are being improved.

Kursk Magnetic Anomaly TPK.—This TPK is one of two located in the European USSR and the only one included in the 11th FYP that is not related to the development of energy resources. The name refers to a major iron ore deposit which forms the basis for the TPK. Reserves in the zone between the cities of Belgorod and Kursk that define the heart of the TPK are estimated at over 43 billion tons.[16] About 60 percent of the reserves are rich ore (56–66

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[11] Ekonomicheskaya gazeta, No. 23, June 1980, p. 1.

[12] Kazakhstanskaya pravda, 7 October 81, p. 1.

[13] Partiynaya zhizn', February 1979, pp. 36–42.

[14] Kazakhstanskaya pravda, 11 April 1980, p. 2; Izvestiya, 20 June 1980, p. 2.

[15] Izvestiya, 20 June 1980, p. 2.

[16] The entire KMA deposit stretches 850 km between Smolensk and Rostov. In combination with other smaller deposits in the center region it contains about 42 percent of Soviet iron ore reserves. Paul Lydolph notes, however, "most of this great reserve of ore lies deep beneath the

Continued

percent iron content) with the remaining but more accessible 40 percent being relatively low-grade quartzites (35–37 percent iron content) that require beneficiation. Shaft mining began in the region in the 1930s and the first open-pit mines were started in the early 1960s. Creation of the KMA TPK was called for in the Ninth FYP, and with that decision, iron ore output began to grow dramatically. Production grew from 17.6 million tons in 1970 to 37 million tons in 1977. Output reached about 39 million tons in 1980 or about 16 percent of total USSR iron ore production. This growth catapulted the KMA into second place behind only the Ukraine's Krivoy Rog Basin. About 30 percent of the ore produced is shipped to iron and steel plants in the Urals, a similar amount to the iron and steel plant at nearby Lipetsk and lesser amounts to plants at Tula and Cherepovets. Ore from the KMA is also shipped to the Katowice plant in Poland.[17]

The increase in production has come from the construction and expansion of open pit mines and concentrators at deposits in the Gubkin-Stary Oskol and Zheleznogorsk districts. The Soviets originally hoped to build an 8–12 million ton conventional integrated iron and steel plant in the KMA with the participation of CMEA countries. This idea has been substantially altered. Instead, a much smaller direct conversion electric steel plant being built by a West German consortium headed by Krupp at Staryy Oskol. The plant will have an initial annual steelmaking capacity of about 2 million metric tons, with further expansion to over 4 million tons planned. The industrial development ongoing in the region will create a heavy burden on local water resources. These are to be augmented by the planned construction of a 300 km Oka–Don–Oskol Canal. Much of the electricity for the plant is to be supplied by a nuclear power plant at Kursk.[18]

Sayan TPK.—Creation of the Sayan TPK was initially called for in the Ninth FYP (1971–75). The TPK is located at the southern tip of Krasnoyarsk Kray in East Siberia, along the Yenesey River just south of the major industrial city of Krasnoyarsk and the coal based Kansk-Achinsk TPK. Because of the proximity of these two TPKs, and the relatively well developed transportation network linking them together, the entire southern portion of Krasnoyarsk Kray has been the focus of a major Soviet development effort since the 1970s.

At the core of the TPK is the partially completed Sayan hydroelectric power station which will have a final capacity of 6.4 million KW. The principal industrial consumer of the power from this station will be an aluminum plant being built nearby at the new town of Sayanogorsk.The plant will be built by the Klockner group of West Germany under a compensation agreement worth $310 million. The agreement was signed after Alcoa withdrew because of US sanctions related to the Soviet invasion of Afghanistan.[19] The

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surface and under water-bearing rocks which make exploitation difficult . . . (and) explains why the KMA ore has not been exploited to any extent previously." Paul E. Lydolph, Geography of the USSR, Elkhart Lake, Wisconsin: Misty Valley Publishing, 1979, p. 309.

[17] Theodore Shabad, "News Notes," Soviet Geography: Review and Translation, 21 (April 1980). p. 254.

[18] Lydolph, 1979, pp. 317–312.

[19] New York Times, 5 October 1980.

other major developments planned for the TPK are a large railroad car plant at Abakan and an industrial park of about a dozen plants of the electrical equipment industry that are to be co-located on a single site in Minusinsk.[20]

The Krasnoyarsk Kray Executive Committee and Kray Gosplan have taken an unusually active role in planning the development of the Sayan TPK as well as other areas of the Kray.[21] As part of the effort to improve coordination among responsible ministries involved in developing the Sayan TPK, an Interdepartmental Commission for the Distribution of Productive Forces was organized under the Kray Executive Committee. In addition the Kray Gosplan has had its responsibilities for short and long-term planning enlarged. Of course, these regional organizations still possess little real authority over the more powerful central ministries. Their role in the development of the Sayan TPK apparently is largely advisory. Nonetheless, it is possible that other oblast level governments may try to emulate these organizational structures, especially if Krasnoyarsk begins to enjoy success with them.

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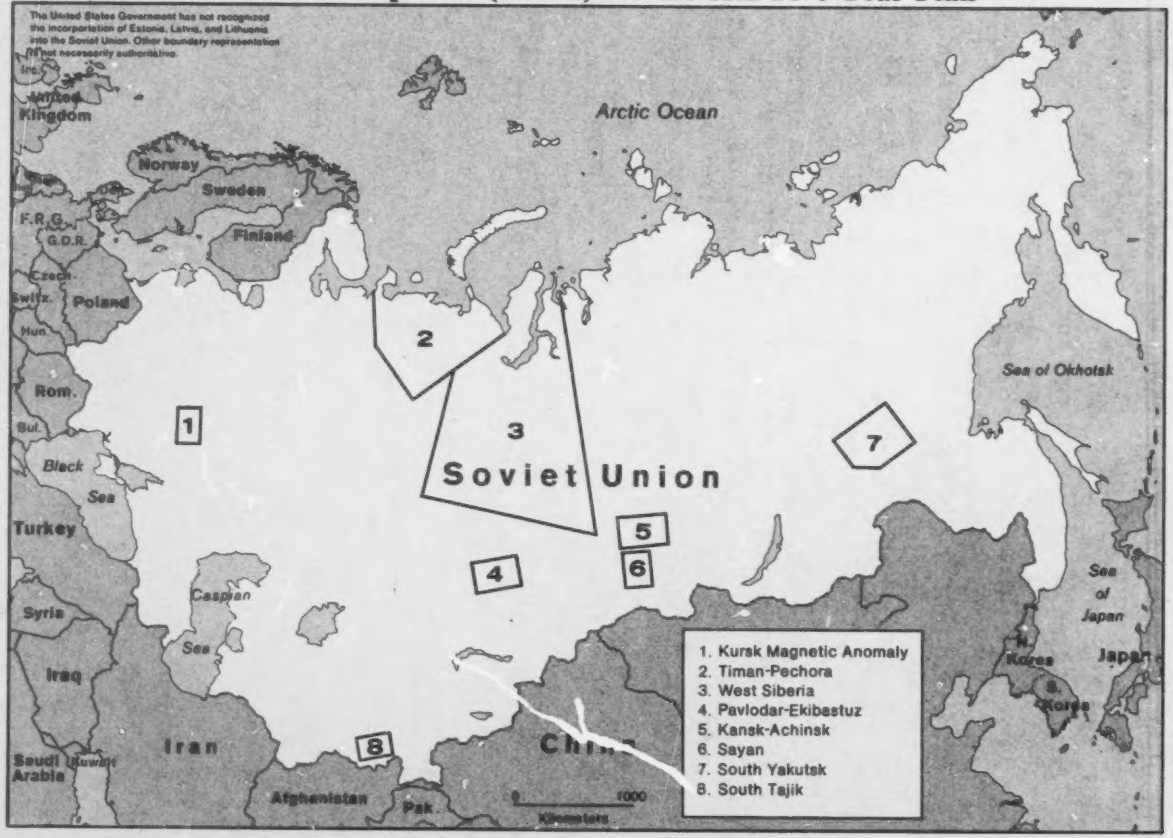
[20] The Abakan Railroad Car Plant is a classic case of the kind of problems that afflict TPK development. The decision to build the plant, which has a planned capacity of 40,000 cars per year, was made in 1968 before creation of the Sayan TPK formally began. Work on this all-union construction project began in 1970 with completion expected in 1976. But then work on the project practically ceased. The Ministry of Heavy Machine Building cut planned capital investment to the project in response to Gosplan's demand to begin construction on an assumedly higher priority project, a large shipping container manufacturing plant at the same site. In 1975, the railroad car project was allocated only 12 of the 80 million rubles of planned investment. Yet even after the container plant was finished the railroad car plant did not benefit because the construction trust was diverted to work on the Krasnoyarsk excavator plant. Although much of the support base and the exterior building construction of the railroad car plant now have been completed, much work remains to be done before the railroad car plant begins operation. See, Pravda, 12 December 1980, p. 3.

[21] G. Shabayev, Ekonomicheskaya gazeta, No. 50, December 1981, p. 10.

Territorial Production Complexes (TPK's) for the 11th Five Year Plan



The United States Government has not recognized the incorporation of Estonia, Latvia, and Lithuania into the Soviet Union. Other boundary representation is not necessarily authoritative.

Arctic Ocean
Soviet Union
Ire.
United Kingdom
Norway
Sweden
Finland
F.R.G.
G.D.R.
Czech.
Switz.
Poland
Hun.
Rom.
Bul.
Black Sea
Turkey
Syria
Iraq
Saudi Arabia
Kuwait
Iran
Caspian Sea
Afghanistan
Pak.
China
Sea of Okhotsk
Sea of Japan
Japan
N. Korea
S. Korea
0
1000
Kilometers
1
2
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1. Kursk Magnetic Anomaly
2. Timan-Pechora
3. West Siberia
4. Pavlodar-Ekibastuz
5. Kansk-Achinsk
6. Sayan
7. South Yakutsk
8. South Tajik

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A NOTE ON SOVIET INFLATION[1]

By Gregory Grossman*

CONTENTS

Page
I. Introduction 267
II. Methods to estimate the amount of currency in circulation 269
  1. Extrapolation with the help of time relatives of other ratios revealed in soviet sources 270
  2. Cash flow to and from the household sector 270
  3. Reconstruction of the State bank's balance sheet 270
  4. Balance-sheet increments 271
  5. Survey technique 272
III. Method 4—balance-sheet increments 274
IV. The "residual" 276
V. "Other accumulation" 277
VI. 1980 279
VII. Conclusion 284

TABLES

1. USSR: Annual increments in selected assets and liabilities of the banking system, 1975–80 273
2. USSR: "Other accumulation," 1976–80 279
3. USSR: Increments in short-term loans outstanding and inventories, and profits 1976–80 280

APPENDIX TABLE

USSR: Selected assets and liabilities of banking system, 1965–80 285

I. As the 1970s waned and the 1980s began, signs of goods shortages multiplied and intensified. It soon became apparent that the Soviet economy may have entered a new phase in this regard. By anecdotal information, much of it appearing in the Soviet press, consumer goods were disappearing from the shelves of official stores more frequently and reappearing less frequently than usual; food, especially, became less available in official outlets,[2] and the search for it, by all indications, came to weigh heavily on the public's minds and efforts. But the growing shortages were by no means limited to foodstuffs, afflicting a broad variety of consumer goods of almost every kind. And not only consumer goods. Anecdotal evidence suggests that industrial materials and other types of producer goods may have been also increasingly difficult to obtain in the late 1970s and the early 1980s.

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[2] A survey of 782 Soviet travellers in western Eurpoe in 1981 found that only three of 19 foodstuffs (including vodka) were at the time regularly available in official stores in at least 80 percent of the 102 cities and towns from which the respondents hailed, namely, sugar, bread, and vodka (Radio Liberty: 1982, p. 5).

In corroboration of the evidence of growing shortages, there soon appeared reports of the introduction or widening of consumer-goods rationing, primarily foodstuffs. While no formal, nationwide consumer rationing seems to have been introduced, as of the time of this writing (mid-1982), formal rationing (coupons, cards) has been put into effect in a number of localities, judging by scattered reports in the Western and especially émigré press. On the other hand, *informal* rationing ("so much per purchase per customer") seems to be widely practiced, most notably in Moscow where it apparently affects nearly all foodstuffs except bread.[3]

A series of expectable related developments have also been widely reported. These include, first, considerable price increases in the legal free markets, such as the so-called kolkhoz markets that handle mostly food, and in the various grey and black markets. Further, one can also observe a general spread and growth of a great variety of illegal and semi-legal private activities (the "underground" portion of the "second economy" and of informal activities, such as barter, between socialist entities ("shadow economy" in our terminology),[4] and the closely associated graft and corruption. The anecdotal evidence on illegal private activities, the shadow economy, and especially corruption, is of course particularly resistant to generalization, though we may note by way of reassurance that the latest all-Union campaign aimed at suppressing economic crime and corruption has been under way during just the period here under review.

The explanation most readily offered both in the Western press and by official Soviet sources is the inadequacy and even absolute diminution of the supplies of individual goods. The official Soviet press has been also conveniently playing up criminal diversion of supplies into the black market by greedy trade personnel, which may well have been taking place under the circumstances but is hardly the root cause of the shortages.

What are the causes? Diminishing supplies, possibly aggravated by hoarding? Indeed, production has not fared well in the USSR in the late 1970s and in the 1980s to date. There has been the unprecedented occurrence of four major grain crop failures in a row, 1979 through 1982, some other food crops have done poorly, and despite the very large imports of grain for feed, the output of meat and milk has also been on the decline, particularly in per capita terms, since 1979, according to official statistics.[5] In other respects, too, the Soviet economy has performed distinctly less well since 1979 than previously, whether one refers to official Soviet data or to Western recalculations. Especially lackluster was the year 1979. Indicative of the problems of that year, and at the same time in part a cause of them, is the fact that in 1979 the total amount of freight hauled by the railroads declined by 2.35 percent, the first absolute decline in this statistic in peacetime since 1938.[6]

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[3] The authorities have also taken other kinds of measures in face of the shortages of foodstuffs, such as lowering sanitary standards in food processing plants in order to augment supplies (private information from a knowledgeable Soviet source).

[4] Cf. Grossman: 1982

[5] To give credit where credit is due, we note that the poor Soviet grain crops of the latter half of the 1970s need not have been a surprise. In a 1976 report on recent Soviet climatic change and the outlook for the rest of the decade, the CIA foresaw an unfavorable phase of the climatic cycle during 1976–80, and projected as "the most realistic" case an average annual grain crop of 200 million m.t. (Soviet basis) during the five years. (CIA: 1976, p. 2.) The actual figure was 205 m.m.t. The Soviet goal was 217 m.m.t.

On the other hand, official Soviet data show only general leveling off in the overall consumption of major foodstuffs per capita after 1978,[7] and continued rise for non-foods. Thus, these official data in themselves provide no strong support for the popular impression of seriously growing and spreading (physical) shortages of foodstuffs—not to say all consumer goods—in the recent period, though they do show declines in per capita consumption of specific foods in specific recent years.

Belaboring the obvious, we remind ourselves that change in supply is only one factor that might cause a shortage (Soviet: *defitsit*) of a particular commodity at a particular time and place. Change in demand backed by purchasing power is obviously another. Yet another factor is price inflexibility. A shortage will not arise if the price can and does move to a new equilibrium level dictated by the new demand-supply balance. Lastly, in a formal sense, shortage can be prevented by effective rationing, although the consumer with excess cash in his pocket may not see it this way.

The official prices of a number of consumer goods were raised in the last several years, though not of such "political" goods as meat, dairy products, bread, and housing. Apparently they were not raised enough to prevent or squash the overall shortages.

II. The purpose of this Note is to inquire into a possible cause of recent consumer goods shortages which seems to have received relatively little attention; namely, an increase in consumer purchasing power, and particularly in the amount of currency (notes) in circulation. Currency is almost the only means of payment used by households for purchases of goods and services in official outlets.[8] On the other hand, firms and institutions are permitted to use currency only for very small payments—other than wages—and to hold only very small amounts of it on hand. An important exception are collective farms which seem to have considerably more latitude to use currency. Yet another important exception, of course, is the underground economy, which—as in other countries—relies on currency for obvious reasons.

The other major means of payment in the USSR is bank money, the clearing deposits of enterprises (*raschetnye scheta*, "settlement accounts"), other enterprise deposits, and the current accounts (*tekushchie scheta*) of kolkhozes and non-business entities. Also as part of bank money there are various earmarked accounts of enterprises and other entities. The bank money functions somewhat like the checking or gyro accounts in the West, but its payment circuit is rigidly separated from the currency payment circuit.[9]

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[6] For general data on 1979 cf. CIA: 1981, passim, especially pp. 30, 38, 57, 60. For railroads see Hunter/Kaple: 1982.

[7] Nar. khoz. 1980, p. 405 (non-food items on p. 406); Brezhnev in Pravda, May 24, 1982.

[8] A negligible proportion of payments by households is accounted for by noncurrency means, such as the so-called certificate rubles representing foreign currency, personal checks, scrip of local significance, savings account balances by way of deduction of regular charges (e.g., rent, utilities), to name a few exceptions.

[9] On the two payment circuits and related matters see Garvy: 1977 and other authorities.

The last published Soviet figure for the absolute amount of currency in circulation pertains to 1 January 1938—1,518 million new (post-1960) rubles.[10] All figures for later dates have been suppressed and remain a state secret to this day. There are perhaps five methods to estimate the amount of currency in circulation for later dates, data permitting, the fourth being a variant of the third. They are:

1. Extrapolation with the help of time-relatives or other ratios revealed in Soviet sources. In this way, on the basis of a few bits of none-too-precise information, Powell estimated currency circulation to have been 3.70 billion rubles (BR) on 1-1-1951 and 5.60 on 1-1-1956.[11] (Since Powell obtained these figures by interpolation from an indirect Soviet statement referring to 1958, it is possible to extrapolate to 1-1-1958. Doing so, one obtains the figure of 8.26 BR.) In an unpublished doctoral dissertation, completed in the year of publication of Powell's estimates, Christine Wollan (now Williams) uses the same Soviet statements to obtain a very similar figure for 1958, and to interpolate linearly for the preceding years.[12] To our knowledge, Soviet sources have not revealed any information that would permit us to extrapolate the amount of currency in circulation beyond 1-1-1958.

2. Using cash flow to and from the household sector, Igor Birman has attempted to estimate the change in currency circulation with reference to so-called "Balance of Money Incomes and Expenditures of the Population." [13] This is an accounting of currency flows to the household sector from the socialist sector and in the reverse direction. An excess of income over expenditure, the latter defined to include the public's purchase of state bonds and deposits in savings banks, is theoretically equivalent to an increase in the public's currency holdings over the period in question. A minor point: currency holdings by households are not equivalent to currency circulation, for the latter also includes currency holdings by entities other than households, except banks, such as enterprises, kolkhozes, government agencies, etc.

Birman estimated the cumulative excess of household income over household expenditures during 1961–1978 to have been 79.4 BR, a figure that he adjusted downward—"quite arbitrary", "more on intuition than on precise knowledge"—by one third to obtain (rounded) 54 BR. The latter figure works out to just 3 BR per year over 1961–1978. Unfortunately, Birman's calculations, at least as yet, do not go beyond 1978. It would be interesting to know what his method yields as the increment to household currency holdings in 1980, the focal year of the present Note.[14]

3. Reconstruction of the State Bank's balance sheet. Soviet currency consists of notes and coins, though in value terms the share of coins must be quite small. The notes are issued by the State Bank of the USSR (Gosbank) and, as in the case of all banks of

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[10] The 1-1-1938 figure is give by Melkov: 1969, p. 88. Melkov carries the figures of currency calculation at mid-1940 on the basis of some indirect data in Soviet sources (p. 91).

[11] Poweil: 1972, especially Table 17.1, p. 404. For a survey of estimates of Soviet currency circulation see Garvy: 1977, Appendix B, "Availability of Monetary Data".

[12] Wollan: 1972, especially Table 16, pp. 285ff.

[13] Birman: 1981, Chapter VI.

[14] Ibid, pp. 120–121.

issue, are a liability on the Bank's balance sheet. Hence, it is in principle possible to approximate the value of notes in circulation by reconstructing the balance sheet, at least in its main items. Several such attempts have been made. In the works already cited, Powell and Wollan attempted just that; Powell for several years from 1928 to 1967, Wollan annually for 1932 to 1970 (excluding the war years). It must be stressed, however, that neither Powell nor Wollan attempted to estimate the amount of notes in circulation in this way; rather, both used method (1), as already mentioned. The reason is that their reconstructed annual balance sheets, though quite detailed, still yield a difference between the debit and credit sides of the ledger that cannot be easily identified with the item "notes outstanding".

4. A variant of the preceding method is the reconstruction of annual changes in those items of the Bank's balance sheet for which such data are availatable or estimatable, hoping that the unexplained residual change (credit or debit) will approximate the change in the value of notes in circulation. This method cannot yield an estimate in the amount of notes outstanding at any given date, of course; at best only an approximation of the change in this amount. But this may still be an important statistic, especially if in any year the value of the change deviates drastically from the corresponding figures for the previous years. Thus a sharp algebraic increase from one year to another in the difference between the total of known increments of assets and the total of known increments of liabilities--i.e., a sharp increase in the second difference between successive absolute amounts—may signal an unusual increase in an unknown liability item such as notes outstanding.

An attempt of this kind was made by Ames for 1956 through 1960,[15] who called the residual "apparent change in Soviet deposits and notes", for his known items did not include enterprise deposits. In three of the five years the residual was negative, i.e., the known increments in liabilities exceeded those in assets. Ames did not carry the attempt any further analytically.

As was just noted, the method of balance-sheet increments has the major drawback of being incapable of yielding absolute estimates of the amount of notes outstanding, or, for that matter, relative changes in notes outstanding. It can only suggest absolute changes in notes outstanding, and of course relative changes of changes. But should these results suffice, then it does have some significant advantages over the balance-sheet reconstruction method. First, it need not be concerned with balance-sheet items which may be large in themselves but change (absolutely) little from year to year, and may not be available or easily estimatable. A case in point may be the Bank's capital account. Second, it can utilize data available only as flows (as against stocks), which, however, can be taken as proxies for changes in certain stock categories (i.e., balance-sheet items). An example is the budget surplus or deficit, which might be taken as a proxy for change in the Treasury's account with the Bank ("Budget Account")—though, as will be assumed below, the proxy relationship may not be very dependable in the Soviet case.

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[15] Ames: 1965, p. 168.

5. Lastly, the survey technique. Emigrants from the USSR can be asked to estimate the amount of currency which they individually had on hand at a particular point in the past while still in the USSR. This was done in the Ofer-Vinokur survey of Soviet émigrés in Israel,[16] and is currently being attempted in a similar survey undertaken by the present author jointly with Professor V. G. Treml of Duke University.[17] As a way of estimating Soviet currency circulation this method faces some considerable difficulties, such as the problems of recall by respondents and of generalizing from the sample to the total population of the USSR.

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[16] The data on currency holdings have not yet been published, but related findings on household savings patterns are reported in Ofer/Pickersgill: 1980.

[17] The questions pertaining to currency holdings is only incidental to our survey, which aims at a better understanding of the Soviet second economy and related matters. The project is funded by the Ford Foundation.

TABLE 1.—USSR: ANNUAL INCREMENTS IN SELECTED ASSETS AND LIABILITIES OF THE BANKING SYSTEM,[1] 1971–1980

[Billions of rubles]

	1971–75 annual average	1976	1977	1978	1979	1976–79 annual average	1980	Change in increment, 1980 minus 1976–79 [(7) – (6)]
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ASSETS								
1. Loans "to the national economy and the population", total:	(13.304)	(23.824)	(26.169)	(20.883)	(25.477)	(24.088)	(42.067)	(17.979)
2. Loans, short-term, "to the national economy and the population"	11.160	16.856	16.336	12.327	18.960	16.120	36.374	20.254
2a. of which by Stroibank	(0.931)	(3.152)	(3.176)	(4.621)	(3.182)	(3.533)	(12.547)	(9.014)
3. Loans, long-term, "to the national economy and the population"	1.879	6.968	9.833	8.556	6.157	7.968	5.693	−2.275
3a. of which by Stroibank	(1.600)	(2.296)	(6.094)	(3.636)	(1.701)	(3.432)	(1.304)	(−2.128)
4. Gold[2] and foreign exchange[3]	.3	−1.4	0	−1.3	−2.1	−1.4	.2	1.6
5. Total of listed assets increments	13.339	22.424	26.169	19,583	23.577	22.688	42.267	19.579
LIABILITIES								
6. "Monetary means" of enterprises (excluding kolkhozes)	2.160	1.061	2.056	2.860	1.687	1.916	3.379	1.463
7. Savings deposits plus Gosbank personal current accounts	8.882	12.020	13.665	14.467	15.132	13.821	10.292[5]	−3.592
8. Current accounts of trade unions, social, and other organizations	.125	.125	125	.125	.125	.125	.125	0
9. Current and special accounts of kolkhozes	0	.2	.2	−.1	−.3	0	−.5	−.5
10. "Indivisible funds" (monetary portion) of kolkhozes	.1	.1	.1	.1	.1	.1	.1	0
11. Gosbank interbranch float	.3	.5	.4	.5	.3	.4	.4	.0
12. Budget surplus as published[4]	3.1	5.5	5.0	5.6	5.1	5.3	8.1	2.8
13. Total of listed liabilities increments	14.667	19.506	21.546	23.552	22.144	21.662	21.896	.234
14. Residual A (RA) = 5. - 13.	−1.3	2.9	4.6	−4.0	1.4	1.0	20.4	19.3
15. Residual B (RB) = 5. - (13.+3.−12.)	−.1	1.5	−.2	−6.9	0	−1.6	22.8	24.4
16. Residual C (RC) = 5. - (13.−12.)	1.8	8.4	9.6	1.6	6.5	6.3	28.5	22.1
17. Residual D (RD) = 5. - (13.+ 3.)	−3.2	−4.0	−5.2	−12.5	−5.1	−6.9	14.7	21.6

Sources: Appendix table except as footnoted.

[1] Gosbank and Stroibank combined. Note that savings banks are within Gosbank.

[2] Change in gold reserves as given in CIA: 1981, p. 63, valued at one ruble per gram (31.1 rubles per oz. tr.).

[3] Change in Soviet assets in Western commercial banks plus trade credits extended to finance Soviet exports (the latter negligible in size), converted to rubles at average official exchange rates. Sources: CIA: 1981, pp. 61 and 54, respectively.

[4] Proxy for increment in Budget Account; see text.

[5] 1981 increment - 9.2 BR.

III. The fourth method—the method of balance-sheet increments—is the one employed in this Note. Table 1 is our basic table. Its purpose is to calculate alternative "residuals", which may be approximate indications of *changes* in the value of notes outstanding. Data in Table 1 are derived in most part from the absolute figures in the Appendix Table. The period of study is 1971 through 1980, inclusive.

Although Gosbank is the sole Soviet bank of issue, Table 1 presents a consolidated accounting, combining data for the two major Soviet banks, Gosbank and Stroibank.[18] The reasons for including Stroibank data are as follows. (1) Our data for enterprise deposits (presumably the overwhelming part of our item "Monetary means of enterprises") comprise deposits at Stroibank as well as those at Gosbank; the two cannot be separated. (2) The breakdown of loans by debtor branch and by purpose of credit is available at this time for 1980—the key year in our analysis—only for the two banks combined. (3) The jurisdictional line between lending by the two banks shifts significantly on occasion, as for example in 1977. Thus, the combined loan totals give a more accurate picture of the course of credit expansion. (4) There are indications, to be taken up below, that Stroibank may bear considerable responsibility for the recent monetary problems.

It should be noted that the savings banks have been an integral part of Gosbank since the beginning of 1963 and their balance sheet is consolidated with Gosbank's. The only remaining bank (not counting the Soviet banks abroad or the CMEA banks) is the Bank for Foreign Trade (Vneshtorgbank). It maintains enterprise deposits and extends credit. Neither its deposits nor its loans are part of the entries in Table 1.[19]

We now proceed to discuss the individual items in Table 1. Lines 1 through 3, loans, are official Soviet data as published in Nar. khoz. 1980, pp. 527ff. (Earlier issues of the statistical yearbook may have slightly different figures owing to re-definitions of short- and long-term loans.) The increments in loans outstanding may in fact be somewhat understated (for our purposes) owing to periodic writing off (forgiving) of the indebtedness of collective farms, and possibly of state enterprises and other entities as well. When the write-off takes place, the banks' assets must be reduced, but we do not know what is the exact offsetting entry, and therefore cannot tell the exact effect on our "residuals".

Line 4: increment in Gosbank's gold holding is taken to be equal to increases in the USSR's gold reserve as estimated by the CIA in physical units and published in CIA: 1981, p. 63. The physical units are valued at the official Soviet ruble/gold parity of 0.987412 grams of gold, here rounded to 1 ruble per gram or 31.1 rubles per troy ounce. The foreign exchange holdings are Soviet assets in Western commercial banks (including very small amounts of Soviet trade credits) as reported in CIA: 1981, p. 61, converted into rubles at the average official rates given on p. 54.

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[18] The full name of Stroibank is All-Union Bank for the Financing of Capital Investment. Despite the name, in the late 1970s its portfolio consisted in almost equal parts of short-term and long-term loans, and in 1980 short-term loans considerably overtook long-term ones. See Appendix Table.

[19] A skeletal balance sheet for Vneshtorgbank as of 1-1-1974 appears in Garvy: 1977, p. 154.

Line 6: "monetary means" of enterprises (excluding kolkhozes), sources as in dictated in Appendix Table. It is not entirely clear what this category encompasses. As noted, it probably includes deposits in Vneshtorgbank and to this extent may be somewhat overstated for our purpose. It almost certainly includes deposits in Stroibank, which belong in our calculation. It probably also includes the legal currency balances held by enterprises. Soviet firms are not allowed to hold more than a bare minimum amount of currency. These amounts probably are not significant except for the balances deriving from retail sales proceeds, which must be deposited very quickly, and the sums, held very briefly, intended for wage payment. To the extent that the category captures some portion of notes outstanding it is overstated for our purpose. However, the distortion is probably not large, at least in regard to the legally held currency. On the other hand, there is ample evidence that Soviet firms hold substantial secret (illegal) amounts of currency for their own pruposes, not to speak of the amounts held by individual officers of enterprises as part of the private underground economy. Needless to say, these illegally held balances are properly inclusible in the results that we seek to obtain.

Line 7 derives from the official Soviet statistics of savings deposits and individuals' non-savings deposits in Gosbank. The amounts given in Table 1 refer to the sum of the two categories given in the Appendix Table. But in fact the individuals' non-savings deposits in Gosbank are very small and contribute almost nothing (0.1 BR) to the increment over the whole ten years.

Lines 8 through 11 represent blance-sheet categories which—though not negligible in themselves—have very small increments (decrements), at least as these have been estimated by us. Their estimation is explained in the Notes to the Appendix Table.

Line 12: annual budget surplus as published, which stands in proxy for the change in the deposit of the USSR Ministry of Finance with Gosbank. A true budget surplus in cash terms would presumably increase the deposit—Gosbank's liability—by an equal amount. It will be recalled that receipts from the sale of bonds to households appear in the Soviet budget as revenue and not a charge against the budget surplus. The big question, of course, is whether the published figure for the budget surplus is in fact more or less the correct figure for a surplus in cash terms. It has been frequently suggested by Western observers that the budget surplus is not what it purports to be, and particularly that it is no surplus at all. Rather than join this issue we assume for the moment that it can stand as proxy for the change in the Treasury's account with Gosbank. When we compute the "residuals" of the table we alternatively include and exclude the budget surplus from the total of known increments on the liability side.

Table 1 does not cover the whole of the combined balance sheet of the two banks. We briefly dwell on only a few of the missing categories. There may be loans other than those "to the national economy and the population", for instance to the Treasury. Nothing is known about such other loans, but they, and their annual changes, may not be insignificant. Second, still on the asset side, there is vault cash in the two banks, though the annual change in this item is probably not large relative to the change in the major balance-sheet categories. There are sundry assets to be borne in mind, including the physical plant of the two banks; again, there is little reason to expect large changes in their value from year to year, except at times of major physical-asset revaluation, which did not occur in the decade in question.

On the liability side, apart from the already mentioned conundrum of the Budget Account, the major omitted item is probably Net Worth, i.e., the net sum of the statutory capital of the banks, various formal reserve funds, and retained profits. This category could be significantly affected from year to year by dint of loan write-offs. Regarding changes in the retained profit amount, no data are available on the banks' current profits, but some notion of their maximum value can be obtained as follows. The two banks presumably fall into the category "other branches of the economy" in the Soviet tabulation of profits by branch. The "other branches" had aggregate gross profits (before losses of some enterprises) of 3,618 million rubles per year on the average during 1976–79 and 3,463 MR in 1980.[20] Of this, payments to the Treasury may have taken about 60 percent (the approximate ratio that held for the whole economy in 1976–80), leaving for retention some 1.4–1.5 billion rubles. Of this amount, the two banks would have accounted for only a part. In other words, the omission of change in retained profits from Table 1 is probably not serious for our purpose.

IV. The object of Table 1, as mentioned, is to arrive at the difference between the total of known (or estimated) increments to assets and the total of known increments to liabilities in a given period, as a way of obtaining an insight into the change in "notes outstanding", a major but unpublished liability item in the Gosbank's balance sheet. Let us call the just-mentioned difference the "residual". A positive residual, in effect, means that the sum of unknown increments to liabilities (including net worth) exceeds the sum of unknown increments to assets (i.e., net unknown liabilities are positive), and conversely if the residual is negative. However—and this cannot be emphasized enough—we do not identify the residual with an increment or decrement in notes outstanding. Nor is even the residual's sign conclusive in regard to the change in notes outstanding. The reason is, of course, that other unknown items of the balance sheet, both assets and liabilities, are changing at the same time. We are interested primarily in the change in the residual from year to year. A sudden and large[21] change in the residual alerts us to a possible significant increase in the annual increment in notes outstanding, in other words, a possible significant increase in currency issue.

Returning to Table 1, the residual as just defined appears on line 14, which is line 5 minus line 13. We designate it as Residual A (RA). However, our list of liabilities may need two major adjustments, both with reference to the Budget Account. First, as mentioned, the budget surplus (line 12) may not be a true cash surplus. Assuming this to be the case—more exactly, that there is neither a cash surplus nor a deficit in every year under consideration—we regard line 12 to be zero and reduce line 13 accordingly. Second, it seems to have been Soviet policy to finance net increases in long-term loans by appropriations from the budget to the banking system.[22] If so, we have understated the increments in liabilities; hence, we increase line 13 by the amount on line 3 for all years.

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[20] Nar. khoz. 1980, pp. 503–504.

[21] What is a "large" change in the residual? Let us say arbitrarily that a change of four percent or more in (official) personal disposable money income (DPMI) is large. DPMI has been estimated at 166 BR in 1970, 223 BR in 1975, and 247 BR in 1977. Extrapolating from 1977 to 1980 at an estimated 4.7 percent per year we get 284 BR. Four percent of 284 BR is 11.4 BR.

Making both adjustments to RA we obtain Residual B (RB). Alternatively, adjusting RA only on account of the budget surplus we obtain Residual C (RC). Finally, adjusting only on account of long-term loans we obtain Residual D (RD).

As we scan the four residuals (lines 14 through 17), we discover relatively little fluctuation from year to year, or even between the annual average for 1971-75 (column (1)) and 1976 (column (2)), except in two years, 1978 and 1980. In 1978 our four residuals drop by amounts ranging from 6.7 to 8.6 BR, the chief factor being a sharp decline in the annual increment of total loans from 26.2 BR in 1977 to 20.9 BR in 1978. Thus, we may entertain a suspicion that currency circulation expanded relatively slowly in 1978, if it did not actually decline. It would be interesting to pursue the 1978 case, looking especially into the reasons for the marked diminution in the growth of total loans in that year, but we resist the temptation for lack of space in the present essay.

Turning to 1980, we find that all four residuals jump up very steeply in that year (columns (5) and (7)), by amounts ranging from 19.0 BR to 22.8 BR, leading us to the strong suspicion of a substantial increase in the rate of currency issue in 1980 as compared with 1979. However, 1979—as already discussed—was an exceptionally bad year for the economy (and indeed our residuals rise considerably in 1979 as well, but this time from the "low" base of 1978). To avoid a distorted impression we compare the 1980 residuals not with 1979 but with the average values of the residuals over the four year period 1976-1979 (column (6)), in this manner, as it were, levelling the cyclical patterns of our residuals over the four years.

The changes in residuals from the 1976-79 averages to the 1980 values are presented in column (8). The values in column (8) range from 19.3 BR to 24.4, actually not very different from what we found comparing 1980 with 1979. If we discard RA as being the least useful of the residuals (for reasons indicated earlier in this section), the range narrows to 21.6-24.4 BR. It is difficult to see how such a large change in residuals could have occurred without a significant upturn in the rate of currency issue in 1980. Presently we shall take a more detailed look at what happened in 1980, but first we digress to discuss yet another suggestive indication of increased currency issue in that year.

V. The Soviet statistical yearbook regularly carries a brief table entitled "Monetary Accumulation of the National Economy (excluding Kolkhozes)," the data going back (with gaps) to 1940.[23] Invariably the table consists of four lines only: the total, profit, turnover tax, and "other accumulation". A methodological explanation in *Nar. khoz. 1969* (p. 30) implies that the total category represents the net income of the national economy (*chistyi dokhod narodnogo khoziaistva*), and it is so construed by the eminent Soviet specialist on finance, A.M. Birman.[24] From his discussion as well as from the official table itself it appears that a more accurate designation for the total category of "Monetary Accumulation" might be "net income of the state from its sector of the economy". The non-inclusion of the kolkhoz sector's net income or of the households' income reinforces this impression.

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[22] Cf. Barkovskii/Kartashova: 1966, p. 47.

[23] Nar. khoz. 1980, p. 503, and corresponding tables in earlier issues. The category of "Monetary Accumulation" is taken up at some length by Igor Birman (1981, Appendix J), whose treatment has been helpful to us, though we do not follow it completely. We also thank Professor V.G. Treml for helpful comments in this regard.

A.M. Birman dwells on the content of the third component, "other accumulation", asserting that it includes, inter alia, social insurance taxes, some agricultural subsidies (as a negative component), and customs revenue, equating the last to the profit on foreign trade in domestic rubles. Leaving the profit on foreign trade aside for the moment, we may ask whether the subcategory "other accumulation", and therefore also the total category, might not also include a particular kind of the state's net income—namely, seigniorage from the issue of paper currency by the State Bank. The fact that A.M. Birman does not mention it is no argument to the contrary, for the censor would surely suppress any such mention. Assuming for the sake of argument that the sub-category "other accumulation" does include seigniorage, we are not surprised to see a sharp jump in the published series in 1980, from an annual average value of 11.0 BR during 1976–79 to 24.0 BR in 1980 (Table 2, line 1). But we can get somewhat closer to seigniorage with the help of two adjustments. First, we add to the published figures for "other accumulation" the annual totals of agricultural subsidies (line 2), drawing on Treml's updated computation for the present volume, and housing subsidies (line 3).[25] Next, following the two Birmans we subtract the yearly amount of social insurance taxes (line 4) to yield Sum H (SH), line 5. As in Table 1, we present the averages for 1976–79 for all lines (column (5)). The last column of Table 2 presents the differences between 1980 values and those for the 1976–79 averages for all lines.

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[24] Birman: 1972, pp. 57–60. This seems to be the fullest discussion of the category in a Soviet source.

[25] Treml: 1982, and *Nar. khoz. 1980*, p. 381, respectively. Cf. Birman: 1972 and Birman: 1981.

TABLE 2.—USSR: "OTHER ACCUMULATION," 1976–80

[Billions of rubles]

	1976	1977	1978	1979	1976–79 annual average	1980	1980 minus 1976–79 [(6) – (5)]
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1. "Other accumulation", [net]......	12.2	11.1	10.1	10.7	11.0	24.0	13.0
2. add: Agricultural subsidies.........	24.3	27.2	30.7	33.1	28.8	37.2	8.4
3. add: Housing subsidies..............	5.2	5.6	6.0	6.5	5.8	6.9	1.1
4. less: Social insurance taxes.......	12.2	12.4	13.1	13.9	12.9	14.2	1.3
5. Sum H (SH)............................	29.5	31.5	33.7	36.4	32.7	53.9	21.2

Sources:
Line 1: Nar. khoz. 1980, p. 503;
Line 2: Treml: 1982;
Line 3: Nar. khoz. 1980, p. 381;
Line 4: Nar. khoz. 1980, p. 522.

Even if our surmise that seigniorage is part of "other accumulation" is valid, SH cannot be taken as a close stand-in for currency issue in any given year. There must be yet other types of the state's profit from its economy, as well as other—though smaller—consumer subsidies that have not been explicitly accounted for in Table 2. Curious, however, is the fact that SH rises smoothly until 1979, but jumps up in 1980 by 21.2 BR (col. (7))—almost exactly the same amount as the sudden upward jumps of the four residuals in Table 1 in the same year.[26]

VI. What happened in 1980? Back to Table 1, we note again the unprecedentally large expansion of loans to the national economy and to the population. In relative terms, total loans increased by 14.0 percent, but short-term loans (just three-fourths of total loans in 1979) increased by 16.2 percent, while long-term loans by only 7.6 percent.[27] More striking is Stroibank's record, which in 1979 accounted for just 18 percent of the combined total for both banks. In 1980, Stroibank's short-term loans rose 46.7 percent; long-term loans, only 3.1 percent.

If it is correct that long-term loans are essentially offset by budget appropriations but short-term loans are not (supra), the slow rate of growth of total long-term loans and the forward surge of short-term loans acquire a special importance from an inflationary standpoint. We note that the 1980 increment in short-term loans was more than double (2.3-fold) the average increment in 1976–79, and nearly double that of the bad year 1979. For Stroibank alone, short-term loans grew four times as much in 1980 as in 1979.

At the same time, the major offset on the liability side to the increase in loans on the asset side, the increment in savings deposits, dropped sharply, by almost five BR in 1980 (from 15.132 BR in 1979 to 10.292 BR in 1980). Seen from another angle, in the latter part of the seventies, growth in savings deposits provided 86 percent of the offset to the growth in short-term loans (and together with growth in monetary means of enterprises—98 percent); in 1980 the corresponding ratios were only 28 and 38 percent.[28] And in 1981, the increment in savings deposits fell further, to 9.2. BR.

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[26] A.M. Birman lists customs revenue as part of "other accumulation", which he then proceeds to interpret as profit from foreign trade. Following his lead, Igor Birman computed "income from foreign trade" as a residual within the "other accumulation" sub-category (p. 286). On foreign trade see Section VI below.

[27] Percentage changes are given in the appendix table.

At first blush it might seem that the slowing down of savings-deposits growth in 1980 and 1981 demolishes any hypothesis of increased currency issue in the USSR. Faster currency issue plus price and wage control equals more forced savings and faster growth of deposits, or so it is generally supposed. But the Soviet repressed inflation is a rather "impure" one, being accompanied by an open inflation in the free (kolkhoz, black) markets, which is just what happend in 1980 and 1981, related at the beginning of this essay. The result is a redistribution of purchasing power from consumers at large to the relatively few, or at least fewer, who profit heavily from the price inflation. Some of the rank-and-file consumers may even have to dip into savings deposits. But those who profit heavily are not likely to entrust their gains to the tender care of the state, for fairly obvious reasons. In sum, the redistribution is not only from buyers to sellers, but may also in part be from depositors to non-depositors. In this manner one might resolve the paradox of declining growth of savings deposits in the midst of faster growth of currency in circulation.

A more detailed picture of what happened in 1980 is provided by Table 3. As compared with 1979, the 1980 increment in total short-term loans outstanding rose almost twice as fast (16.2 against 8.8 percent), and the increment relating to the portion of such loans which directly finances inventories rose more than twice as fast (15.1 against 7.0 percent). By branch, the acceleration was especially marked for industry, agriculture, and construction (lines A.l.a., b., and c.). The remarkable 14.9 BR increase in the increment of short-term loans to construction, a 48.7 percent increase in relative terms, checks well with the 12.5 BR absolute increment in Stroibank's short-term loans in 1980 (Table 1, line 2a).

TABLE 3.—USSR: INCREMENTS IN SHORT-TERM LOANS OUTSTANDING AND INVENTORIES, AND PROFITS, 1976–80

[In billions of rubles, except as indicated]

	1979 increment	1976–79 average annual		1980 over 1979		1980 – 1976–79 change in increment [(4) – (2)]
		Increment	Percent increase	Increment	Percent increase	
	(1)	(2)	(3)	(4)	(5)	(6)
A. Loans outstanding,[1] short-term, total of which	18.960	16.120	8.8	36.374	16.2	20.254
1. By branch (selected):						
a. Industry	6.650	4.168	7.6	8.312	12.7	4.144
b. Agriculture	7.255	5.331	16.5	7.418	15.9	2.087
c. Construction	4.684	3.834	18.5	14.906	47.8	11.072
d. Trade	1.520	1.196	2.4	4.064	7.7	2.868
2. To finance goods,[2] total of which	5.619	9.188	7.0	23.414	15.2	14.225
f. To finance production materials	2.629	1.894	4.9	4.327	9.9	2.433
g. To finance work in process	1.783	1.748	27.5	11.048	98.2	9.300
h. To finance finished goods	–.330	–.020	–.5	–.063	–.7	–.043
i. To finance "other goods"[3]	2.170	2.444	19.1	4.058	20.8	1.606
j. Against payment documents	4.023	1.835	6.4	4.790	14.3	2.955

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[28] Calculated from data in table 1, columns (6) and (7).

TABLE 3.—USSR: INCREMENTS IN SHORT-TERM LOANS OUTSTANDING AND INVENTORIES, AND PROFITS, 1976–80—Continued

[In billions of rubles, except as indicated]

	1979 increment	1976–79 average annual		1980 over 1979		1980–1976–79 change in increment [(4)–(2)]
		Increment	Percent increase	Increment	Percent increase	
	(1)	(2)	(3)	(4)	(5)	(6)
k. For "other purposes"	9.318	5.096	21.8	8.170	21.9	3.074
B. Inventories,[4] total of which	16.128	17.072	6.6	20.782	6.9	3.710
a. In industry	6.886	6.037	6.5	8.000	7.4	1.963
c. In construction [5]	.867	1.079	9.0	1.215	8.2	.136
f. Production materials	5.538	6.504	6.4	9.612	8.1	3.103
g. Work in process	3.245	5.392	10.3	5.234	7.9	–.158
h. Finished goods	.273	.570	5.1	.990	7.9	.420
C. Profits [6]:						
1. Retained profits of State and coop. enterprises and organizations[7]	47.9	47.3	.6	47.6	–.6	.3
2. Retained net income of kolkhozes computed as	2.6	[11] 4.2	–43.5	–.2	–105.0	–4.4
Value added [8]	22.2	23.4		19.6		
Less:						
Labor payment [9]	18.6	18.2		18.8		
Income taxes [10]	1.0	1.0		1.0		

[1] Short-term loans "to the national economy and to the population" by Gosbank and Stroibank.

[2] Pod material'nye tsennosti.

[3] Prochie material'nye tsennosti.

[4] Oborotnye sredstva v zapasakh tovarno-material'nykh tsennostei, kolkhozes excluded.

[5] Contract (podriadnoe) construction only.

[6] The absolute data are actual amounts for the given years, not annual increments.

[7] Profits of state enterprises and organizations and of consumer cooperatives.

[8] Valovoi dokhod, defined as gross output less material production outlays and depreciation (p. 254).

[9] Credited to labor in terms of money and goods.

[10] Estimated from data on p. 522; rounded figure.

[11] Our estimates (from data on p. 254) for earlier years are: 1975—4.6, 1976—4.6, 1977—5.1, 1978—4.3. Shown in the table are 1979—2.6 and 1980— –0.2 BR.

Sources: Computed from data in Nar. khoz. 1980, pp. 254, 503, 504, 510–513, 522, 527–0529, and Nar. khoz. 1979, p. 536.

The overall picture one obtains from Panel A of Table 3 is one of an economy in some difficulty in 1980. Net increases in short-term loans to carry inventories of production materials, goods in transit (production documents), and—especially—work in process rose sharply, while net increases in loans to carry finished goods diminished mildly (as they had been doing). The increase in net loans for work in process was no doubt affected by the accumulation of "unfinished construction" in 1979 and 1980, and to this extent probably relates to the already noted sharp increase in net short-term loans by Stroibank.[29]

On the other hand, a look at the data on increments in inventories (Panel B of Table 3) provides no clear support for the just-obtained impression. The rate of increase in inventories—though high in relation to the growth of GNP—shows no particular upturn in 1980 as compared with preceding years, for the total category or for the individual sub-categories listed in the Table. On the contrary, the rate of increase for work in process turns down in 1980 and that for finished goods turns up, the very opposite of what we just observed in Panel A. What seems to have taken place is a shift in sources of financing inventory acquisition. Whereas in 1976–79 increases in short-term loans financed over half of inventory growth (column (2), 9.188 BR of 17.072 BR), and in 1979 the proportion was little over a third (column (1), 5.619 BR of 16.128 BR), in 1980 the increment in short-term loans financed more than the whole of net inventory increment (column (4), 23.414 BR against 20.782). Even more marked is this turnaround in the case of work in process (lines A.2.g and B.g). In sum, in 1980 bank credit seems to have stepped into the economy in a big way, both displacing other sources of enterprise finance and creating an unprecedently large net increase on short-term credit. In this process, Stroibank played an unusually important role.

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[29] In 1979 and 1980 unfinished construction rose by 6.1 BR (slight drop in 1980); Nar. khoz. 1980, p. 345.

One reason for the expanded role of credit may be found in the poor profit record of enterprises and collective farms during the later 1970s and in 1980 (Panel C of Table 3). Retained profits of state enterprises (including a small amount of profits of cooperatives) reached a peak in 1978 and declined moderately in the next two years (line C.1). Retained net income of kolkhozes (as computed in Table 3) peaked in 1977 and dropped sharply thereafter to a negative value in 1980. (Some of the credit expansion in 1980 may have been for the purpose of allowing kolkhozes to meet their guaranteed labor payments.) Clearly, there came to be less room in retained profits to meet investment needs.

But the profit squeeze can explain only a small part of the great expansion in loans in 1980. To the extent credit replaced other sources it must have primarily substituted for the Treasury's funds. Was this substitution in some degree occasioned by the budget's growing burden of consumer subsidies (agricultural, housing—which together grew by 4.5 BR in 1980), the war in Afghanistan, the events in Poland?

Be the reasons as they may, the Soviet scholarly literature has recently begun to hint at a significant increase in currency in circulation and to connect this fact with the surge of credit. Thus, A. E. Melkov—who years ago had already strongly argued the connection between credit expansion and currency issue[30] returned to the theme in late 1981.[31] Once again he stresses the theoretical link between credit extension and money creation, and the fact that the appearance of an excessive amount of money in circulation can be traced to a heedless use of the "credit mechanism."[32] Pointing out the interesting fact that neither money flows nor the amount of money circulation are actually planned, and that long-term loans (as we have seen) and Gosbank's balances with Stroibank, Vneshtorbank, and the "financial system"[?] are supposedly fully covered by "corresponding credit resources", and primarily by savings deposits, Melkov calls for the proper management of lending to avoid excessive money issue.[33]

While Melkov does not explicitly address the most recent years (his examples refer to 1960–1975), another author publishing a few months later, in fact the head of the department of credit and monetary circulation of the USSR Ministry of Finance, V. S. Zakharov, does just that.[34] Also hinting at recent overissue of money (currency and bank money), Zakharov puts his finger on two flaws in the practice of credit extension. First, he points to a recent tendency to increasingly grant credit for general liquidity purposes to ministries rather than to associations and enterprises. One problem here, according to the author, is that ministries are much less punctual in repaying their debts, which has contributed to the recent increase in loans outstanding. Second, referring to the considerable expansion in Stroibank's lending since 1977, especially (as we have seen) short-term lending, he sees in it a cause of dilution of central control over credit and the money supply, leading to an overissue of currency. He calls for more and better centralized planning in this area, and eventually for a merger of Stroibank into Gosbank for purposes of accounting and cash-flow control, as has already occurred with the savings banks.[35]

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[30] Melkov: 1966, Part I.

[31] Melkov: 1981, p. 61.

[32] Ibid.

[33] Unlike many soviet specialists, Melkov argues that bank money, as well as currency, requires attention (1981, passim).

VI. Before concluding this Note, we must address the relationship between credit and currency on one hand and the foreign balance on the other. As has been lately forcefully brought out, in recent years the USSR, i.e., the Soviet state, has been making a very large and growing "profit" from foreign trade in the sense of a surplus of the value of imports over the value of exports, both in domestic prices.[36] It has risen as follows (in BR): 1975—31.5, 1976—36.6, 1977—37.7, 1978—49.5, 1979—52.3, 1980—60.5.[37] These are large amounts, larger than the increment in total loans outstanding in the respective years. Since the sums also represent a net flow of domestic funds to the state, they may well be used to offset (in a balance-sheet sense) an accelerated expansion of credit. However, in order to do so, the "profit" from foreign trade must appear on Gosbank's balance-sheet as a liability: a Treasury deposit, an interbank deposit (say, by Vneshtorgbank), an addition to Gosbank's retained profits, or something else, or a combination of these. Thus it is a potential major alternative to currency issue, both on the Bank's balance-sheet and in terms of our analysis.

It seems a bit doubtful to us that the foreign trade "profit" has in fact been wholly or largely incorporated into the Gosbank balance-sheet during the period here under review, except possibly in 1980. The "profit" has been rising steadily and rapidly at least since the early 1970s. One would expect a reflection of it in the growth of credit (through 1979) and in the movement of either the published values of "other accumulations" or the computed values of SH (Table 2). This is not apparent. On the contrary, we find that the very year, 1978, in which the "profit" took its biggest leap upward (by nearly 12 BR), the increment in credit and our Residuals took a considerable fall (Table 1). However, in 1980 we do observe steep rises in the loan increment, the Residuals, the "other accumulation" series, and in SH. Conceivably this was brought about by a change in accounting practice that channeled the foreign trade "profits" into Gosbank (or another bank) for the express purpose of expanding the lending base. This is possible, in which case our surmise of a considerable increase in currency issue in that year may be seriously weakened if not entirely controverted. But in rejoinder one can point to the articles by Melkov and Zakharov which express concern over an unplanned and uncontrolled expansion in the money supply, link it to credit expansion, and yet reveal no inkling of foreign trade "profits" as an offset to the credit.[38]

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[34] Zakharov: 1982.
[35] Ibid, p. 10.
[36] Treml/Kostinsky: 1982.
[37] Data through 1978, p. 34; 1979 and 1980 kindly privately furnished by Treml.

VII. To return to the beginning, the aggravating shortages of consumer goods in the USSR in the last few years may well be supply determined, and in the case of meat, milk, and a number of other important foodstuffs are that even by official statistics. But the demand side must be given its due. Since 1977, current (official) disposable incomes may have increases by almost 20 percent—food supply has not! Financial assets of households have grown much faster, at least as indicated by a 60 percent rise in savings deposits from the end of 1976 to the end of 1981. And, as we have surmised, there may be some reason to suspect a substantial increases in currency circulation through 1980. The data for 1981 are not yet available in this regard.

Addendum in proof occasioned by the arrival of 1981 data in *Narodnoe khoziaistvo 1922-1982* (Moscow, 1982), which show, among other things, a veritable explosion of short-term bank loans during the year: The reader is invited to compare the following 1981 figures (year-end, billion rubles) with those for 1980 and earlier years in the Appendix Table (percentage increases over 1980 in parentheses in selected instances). Loans, short-term—327.438 (25.2), of which by Stroibank—70.814 (79.8), Loans, long-term—86.195, of which by Stroibank—27.752, Loans, total—413.533 (20.8), Monetary means of enterprises [our estimate by applying the 1980 ratio of this category to total working capital of enterprises]—40.1, Savings deposits—165.5, Current accounts of trade unions, etc. [our extrapolation]—3.5, Current . . . accounts of kolkhozes [ditto]—4.0, Indivisible funds . . . [ditto]—2.6, Gosbank float [ditto]—10.7, Budget surplus (Table 1)—10.8 (33.3). We estimate the residuals (Table 1) for 1981 as follows (which *change* in residuals in relation to 1980 and 1976–79 average in parentheses in this order): RA—48.6 (28.2, 47.6), RB—54.3 (31.5, 55.9), RC—59.4 (30.9, 53.1), RD—43.5 (28.8, 50.4). If our method gave us reason to suspect a substantial increase in currency circulation in 1980, it now gives us reason to suspect a further acceleration of currency issue in 1981. (Relevant data will be found on the following pages of *Nar.khoz. 1922-1982:* 285, 417, 450, 549, 555, 561-62, 567.)

[38a] See also Belkin/Ivanter: 1982, in this regard.

APPENDIX TABLE.—USSR: SELECTED ASSETS AND LIABILITIES OF BANKING SYSTEM, 1965–80

[Billions of rubles at year-end, except as indicated]

	1965	1970	1966–70 a.a.i. percent	1975	1971–75 a.a.i. percent	1976	1977	1978	1979	1976–79 a.a.i. percent	1980	1980 percentage increase
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
ASSETS												
1. Loans, short-term, "to the national economy and the population"	66.690	104.739	9.4	160.541	8.9	177.397	193.733	206.060	225.020	8.8	261.394	16.2
2. Of which by Stroibank	3.311	8.057	19.2	12.714	9.6	15.866	19.042	23.663	26.845	20.5	39.392	46.7
3. Loans, long-term, "to the national economy and the population"	7.340	21.495	24.0	43.503	15.1	50.471	60.304	68.860	75.377	11.6	81.070	7.6
4. Of which by Stroibank	1.258	5.578	34.7	13.582	19.5	15.878	21.972	25.608	27.309	19.1	28.163	3.1
5. Loans, total, "to the national economy and the population"	74.030	126.234	11.3	204.044	10.1	227.868	254.037	274.920	300.397	10.2	342.464	14.0
LIABILITIES												
6. "Monetary means" of enterprises (excluding kolkhozes)	8.916	16.523	13.1	27.322	10.5	28.383	30.439	33.299	34.986	6.4	38.365	9.7
7. Savings deposits plus current accounts of individuals [1]	18.856	46.743	19.9	91.154	14.3	103.174	116.839	131.306	146.438	12.6	156.730	7.0
8. Current accounts of trade unions, social and other organizations [2]	1.545	2.100	6.3	2.725	5.3	2.850	2.975	3.100	3.225	4.3	3.350	3.9
9. Current and special accounts of kolkhozes [2]	3.239	4.56	7.1	4.46	0	4.62	4.86	4.78	4.44	0	3.92	−11.7
10. "Indivisible funds", monetary portion, of kolkhozes [2]	.944	1.350	7.4	2.063	8.8	2.146	2.243	2.333	2.419	4.0	2.470	2.1
11. Gosbank interbranch float [2]	4.297	6.436	8.4	8.054	4.6	8.563	9.004	9.464	9.781	5.0	10.179	4.1

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[1] Includes very small amounts of individuals' non-savings deposits at Gosbank. They totaled 129 million rubles in 1965 and rose steadily to 216 million rubles in 1980.

[2] The relatively minor items on lines 8–11 have been obtained and estimated as follows. Line 8: 1965—as estimated by Wollan; assumed to increase by 110 million rubles per year to 1970 (as it approximately did from 1960 to 1966), and by 125 MR per year from 1970 to 1980. Line 9: 1965—Barkovskii/Kartashova: 1966, p. 144; 1970–1980—on the basis of the relationship in the mid-sixties, current and special accounts of kolkhozes are assumed to be 20 percent of their gross value added (valovoi dokhod). Line 10: 1965—Barkovskii/Kartashova: 1966, p. 144; 1970–1980—on the basis of the 1965 relationship, monetary portion of individual funds assumed to be 2.25 percent of total indivisible funds. Line 11: 1965—Barkovskii/Kartashova: 1966, p. 142; 1970–1980—on the basis of relationship in mid-sixties, Gosbank interbranch float taken as 2.22 percent of national income produced (Soviet figure).

Sources: Nar. khoz. SSSR for relevant years, except as follows: Line 5, all years, computed from data on working capital (oborotnye sredstva) in the national economies (excluding kolkhozes) and the percentage thereof indicated as monetary means (denezhnye sredstva); Nar. khoz. SSR 1980, pp. 510, 511, and corresponding pages of other issues of Nar. khoz. 1965, lines 8–11 are summarized by Wollan; 1972, Table 16, which lists the original sources (see footnote [2] above).

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III. MILITARY ALLOCATIONS AND BURDEN

OVERVIEW

By Abraham S. Becker *

As even grade schoolers know by now, the Soviet Union has suffered a substantial drop in its overall economic growth rates over the past 25 years, particularly since the late 1970s, and the economy is not likely to climb out of its doldrums during the 1980s. Unlike the West, the USSR has not yet experienced absolute decline in aggregate national output and may not do so in the near future. However, there is a consensus among informed Western observers that the recent average two percent annual growth will not be easy to sustain; under very plausible conditions, the Soviet economy could stagnate, at least for much of the rest of the decade.

There is also a consensus on the proximate causes of the slowdown—simultaneous deceleration of increases in factor inputs and factor productivity. According to one of the best known measures, CIA's calculation with Cobb-Douglas assumptions, Soviet factor productivity has been negative in each of the last five years and in nine of the last 11 years. Soviet inability to raise productivity is ascribed to perversity of incentives and rigidities in the planning system.

An important feature of the Soviet economic record is that military expenditures are estimated to have increased monotonically for more than twenty years, notwithstanding the retardation in overall economic growth. From the mid-1960s to the mid-1970s, military outlays grew roughly in tandem with the economy, but CIA has said that military expenditure then maintained its trend rate while the GNP pace of increase continued to fall. By implication, the defense/GNP ratio, the crude "burden of defense" rate, has been rising. Even before this recent development, the crude Soviet burden ratio was higher than in any other developed industrial state and was exceeded only by the extraordinary rates prevalent in the Middle East.

Several major questions then arise: To what extent was the Soviet military buildup responsible for the economic slowdown? Why wasn't the military buildup scaled back as the slowdown sharpened, given detente and the Soviet achievement of (at least) "parity" in global military power with the United States? Facing such poor economic prospects in the 1980s, are Soviet leaders likely to cut back on military expenditure? If not, will the Soviet economy be able to sustain the historic rate of military power accumula-

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tion without forcing potentially dangerous absolute cutbacks in consumption and investment?

The three papers in this section are, in varying degree, concerned with this general issue. The paper by Gregory Hildebrandt focuses specifically on the last question; in doing so, it also throws some indirect light on the first and second. Hildebrandt estimates that variation in the rate of increase of military expenditure from 0 to 9 percent, against a trend rate of 4½ percent, would make an insignificant difference to the GNP growth rate in the 1980s. For example, when defense expenditure is frozen at the base level, the GNP growth rate is increased by at most (in three alternative cases) 0.1 percent per year in 1981-85, 0.5 percent in 1986-90, and 0.3 percent for the decade as a whole. The results flow from a macromodel of the Soviet economy, but they are essentially the same as those Daniel Bond and Herbert Levine drew earlier from the SOVMOD econometric model,[1] and as those CIA drew still earlier from its SOVSIM econometric model.[2] The explanation of these results, at first glance surprising, is that the resources reallocated constitute a small proportion of the capital stock—below 10 percent of the total, thus adding little growth stimulus through the investment process.[3]

Hildebrandt finds that the elasticity of per capita consumption with respect to defense, while still small, is considerably larger than the GNP elasticity—0.02 compared with 0.1, using the macromodel. Thus, freezing defense expenditures produces as much as a 0.9 percentage point increase in the baseline rate of growth of per capita consumption in 1986-90, as compared with only 0.5 percentage point increase in the GNP growth rate. This too accords with the results of the major previous investigations.

Empirical findings in this vein do throw an indirect light on the question of the role of the military buildup in causing or maintaining the economic slowdown. First, while the GNP elasticity of defense outlays is generally low, the consequences of reallocation are the greater the longer the period of time during which it is sustained. Thus, the duration of the trend of uninterrupted increase in Soviet military expenditure, from 1960 on, suggests that the military buildup may have represented a tangible cumulative constraint on the civilian sector by the early 1980s, as compared to what the situation would have been at lower rates of growth of the military budget.[4] Second, the deleterious effects of increasing the rate of growth of military expenditure appear relatively larger than the beneficial results of cutting back, because acceleration of military spending tends to exacerbate existing materials bottlenecks in conditions of declining capital productivity. This factor might also have contributed downward pressure on the GNP growth rate in the past.

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[1] Daniel L. Bond and Herbert S. Levine, "The Soviet Economy to the Year 2000: an Overview," in A. Bergson and H. Levine, eds., The Soviet Economy to the year 2000, Allen and Unwin, in print, and the same authors', "The 11th Five-Year Plan, 1981-1985," in S. Bialer and T. Gustafson, eds., Russia at the Crossroads: The 26th Congress of the CPSU, Allen and Unwin, 1982.

[2] CIA,"Simulations of Soviet Growth Options to 1985," ER-79-10131, March 1979.

[3] At official valuation in "1973 prices," the Soviet fixed capital stock (including livestock) amounted to 1944 billion rubles at the end of 1980; excluding housing and other "nonproductive" capital reduces the total to 1149 billions (TsSU, Narodnoe khoziaistvo SSSR v 1980 g., Finansy i statistika, 1981, p. 69). Total Soviet military expenditure in the same year was estimated by CIA as 70 billion rubles at 1970 prices (CIA Estimates of Soviet Defense Spending, Hearings Before the Subcommittee on Oversight of the Permanent Select Committee on Intelligence, House of Representatives, Washington, D.C., 1980, pp. 6-7). Even a generous allowance for price inflation would not raise the ratio of military outlays to total fixed capital above six percent and the ratio to "productive" fixed capital above nine percent. However, this formulation overstates the implied possible effect of resource reallocation because the numerator of the ratio is total military expenditure. Only part of this expenditure can be converted into investment without substantial time lags or loss of effectiveness. The more appropriate magnitude for consideration of short term reallocations is military investment (procurement and construction).

Hildebrandt is primarily concerned with the tradeoffs between defense and GNP or consumption. The vehicle of the first tradeoff is the investment process, and investment is a competing claim on aggregate resources with defense and consumption. The papers by Daniel Bond-Herbert Levine and Myron Rush are devoted to the investment side of the tradeoff triangle. Bond-Levine estimate the size and growth of the production of military durables—more correctly, an aggregate that is identified with weapons—by the method of machinery production residuals. The very rapid growth of this residual from 1965 to 1980—12 percent per year, in current prices—has meant a very substantial decline in the relative importance of major civilian components, producer and consumer durables, in machinery production. The identification of these "static trade-offs between military and non-military uses of machinery * * * provides a starting point for examining dynamic impacts, through the investment cycle, on the entire Soviet economy," as Bond-Levine did in their 1982 papers cited above.[5]

The increasing claim on machinery resources by the Soviet military was eased in the past by Soviet imports of Western machinery and equipment. The Bond-Levine calculations are intended to show, however, that the role of imports was more restricted than is now often claimed, and in two senses. First, the relative contribution of imports to total machinery supply was never (since 1965) large—a maximum of 9 percent in 1978. The share of machinery imports from the West was, of course, much smaller—no more than 3 percent. The contribution of imports to the machinery component of domestic investment was larger, but still did not exceed 10 percent.[6]

The simple import-to-total-supply ratios calculated by Bond-Levine, as they are the first to note, are inadequate measures of Soviet dependency on machinery imports. The contribution of Western technology and know-how, embodied or disembodied, licitly or illicitly obtained, to the development of Soviet civilian and military production is surely much more important than is indicated by these ratios. However, another factor to be considered is that Soviet exports of machinery industry product also expanded considerably in the Brezhnev period. This is particularly true of arms. Thus, the Soviet machinery balance of trade with the West shows a virtually continuous export surplus when arms are included in the count.[7] The import surplus that shows up in the Bond-Levine calculations at domestic producers prices reflects heavy machinery imports from the Soviet Union's communist trade partners.[8] Bond-Levine conclude:

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[4] Had the savings in resources resulting from a slower pace of increase of military expenditure been used to increase investment, the observed decline in capital productivity arguably might have accelerated. On the other hand, that tendency might have been offset by the possibly higher quality of the resources being diverted from defense uses (although Hildebrandt is sceptical of this argument). If the resources were diverted fully or partially to consumption, a positive effect on GNP growth might be expected through enhanced incentives to increase labor productivity.

[5] There are large divergences between the estimates by Hildebrandt (not shown in his article but underlying the tradeoff calculations) and Bond-Levine (their Table 1) of the growth rates of military and civilian machinery. However, the estimates are not comparable in several important ways: (1) Hildebrandt's estimates are probably derived from values at constant prices, whereas the relevant columns in the Bond-Levine Table 1 are in current prices. (2) Hildebrandt probably employs the broad coverage of military machinery used by CIA, whereas the Bond-Levine residual is confined to the much narrower category of weapons hardware. The divergences in the growth rates of civilian machinery are considerably smaller than those for military machinery, most likely because the scope of coverage of the former category is probably more nearly the same in both studies than is that for military machinery.

[6] These calculations are performed from values in domestic producers prices. Different results would be obtained with alternative forms of valuation.

> Although by importing machinery the Soviets may have relieved some of the pressure of competing demands on the domestic machine building industry * * *, the major result has been to allow them to pursue greater specialization in machinery production, and thus develop additional machinery export capacity. Since one direction of Soviet specializaton appears to be toward arms production, * * * this has perhaps helped to lower production costs for the Soviets' own military durables.

The changing use structure of machinery output in favor of defense is not just a relative disfavoring of producer durables for investment (as well as durables for consumption). Over the same period, the rate of growth of investment as a whole has been declining, even according to official data. In the first 15 postwar years, investment grew very rapidly—at a rate doubling the flow every six years. The rate of growth was cut almost in half in the 1960s, but it was relatively stable at an annual rate of about 7-7½ percent per year until the mid-1970s. The decline then became precipitous in the late 1970s.

Against this background, we can turn to Myron Rush's analysis of the leadership's decision in 1975 to cut the growth rate of investment in the Tenth Five Year Plan (FYP), 1976-80. This seemingly uncharacteristic action is linked to the simultaneous decision to increase the share of national income allocated to consumption, hence to reduce that of accumulation, the other component in Marxist terminology. Ostensibly, this was made possible by gains in productivity, but Rush is struck by the novelty of the call for utilization of productivity gains "to *reduce* the share of national income allocated to investment while *maintaining* the current growth rate of the national economy" (his emphasis).

Interestingly, the 1975 action cutting the share of accumulation in the national income had a very recent precedent. The Ninth FYP had called for exactly the same action: the share of the consumption fund was raised and that of the accumulation fund lowered by one percentage point; in addition the five-year percentage increase in gross investment was lower than in the previous quinquennium.[9]

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[7] Since the early 1970s, Soviets have exported each year roughly twice as large a volume of arms to the West as of machinery.

[8] The USSR's machinery imports in the postwar period have always come largely from the communist world. In the late 1960s and again in the mid 1970s, there was a decline in the share of imports from the "East." Since 1976, the historical trend has reasserted itself and imports from the "East" are now 70 percent or more of total machinery imports. While this description refers to domestic values at producer prices, the general result would not be affected by moving to other bases of valuation.

[9] Gosudarstvennyi piatiletnii plan razvitiia narodnogo khoziaistva SSSR na 1971-75 gody, Politizdat, 1972, pp. 75, 78.

"Accumulation," it should be noted, is not the same as "investment." The investment component of accumulation is in both fixed and working capital, and the fixed capital investment is net of depreciation. Soviet plan documents rarely discuss planned changes in net investment or investment in working capital; the goals cited for "capital investment" or "capital put into operation" refer to forms of gross fixed investment. Decline in the share of accumulation is not necessarily synonymous with a drop in the share of net fixed capital investment, inasmuch as the accumulation fund also includes additions to inventories and unspecified "other outlays."[10] The Ninth Plan is not clear on this matter: it suggests that if the total net fixed investment share was to fall, this was to be largely at the expense of "nonproductive" investment; accumulation in "productive" fixed capital was to increase in relative importance from 9 percent of national income in 1970 to 11 percent in 1975.[11] Unfortunately the data provided by the Ninth Plan for national income accumulation and investment are not quite comparable in scope, as is evident from the following tabulation of planned five-year percent increases:[12]

	Cumulative 1971–75 plan compared to 1966–70	1975 compared to 1970
National income, utilized	(1)	38.6
Accumulation:		
Total	(1)	36.0
In productive fixed capital	(1)	69.0
Gross investment:		
Total	41.6	38.4
In productive sphere	49.2	(1)
In nonproductive sphere	20.5	(1)
State sector gross investment:		
Total	43.2	(1)
In productive sphere	51.8	(1)
In nonproductive sphere	16.5	(1)
State sector gross new capital increments:		
Total	52.0	(1)
In productive sphere	60.0	(1)
In nonproductive sphere	10.0	(1)

[1] Not available.

Because the statistical handbooks provide much different figures on the structure of national income than those cited in the Plan,[13] it is not possible to calculate national income entries for column 1 in this tabulation from the cumulative sums for 1966–70. Since the Plan does not provide 1975 values for gross investment, neither can we compute the corresponding entries in the second column of the tabulation. Nevertheless, it seems clear that with respect to productive fixed capital, net investment was to grow substantially more rapidly than gross investment, although possibly not much more than state sector new capital increments. The relation between these investment concepts is roughly as follows, ignoring some very minor elements:[14]

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[10] This residual category is believed to contain additions to state reserves, and there has been some speculation that this is the channel through which much or most military procurement is reflected in the national income accounts. This contrasts with Rush's interpretation in note 3 of his article.

[11] Gosudarstvennyi piatiletnii plan..., p. 79. The 1970 figure shown in the statistical yearbooks is different. See TsSu, Narodnoe khoziaistvo SSSR 1922–1972, Statistika, 1972, p. 361.

[12] Gosudarstvennyi piatiletnii plan... p. 76, 78, 79, 225. The percentage increase for productive fixed capital accumulation was calculated from the national income increase and the share of this component in the total, given on p. 79.

[13] Cf. the Plan data with figures in Narodnoe khoziaistvo SSSR 1922–1972, p. 361.

1. Gross investment less the change in unfinished construction = gross new increments
2. Gross new increments plus increments from capital repairs less depreciation = net investment

Therefore,

3. Gross investment plus capital repair increments less (the change in unfinished construction plus depreciation) = net investment.

If net investment was to increase more rapidly than gross investment, the difference, capital repair increments minus the sum of the change in unfinished construction and depreciation, must have been expected to increase considerably more slowly than net investment. We know that the volume of unfinished construction (in state sector investment) was supposed to grow by only 8 billion rubles over the five years of the Plan, compared with 23 billions in 1966–70.[15] It therefore appears that planners expected capital repair increments to increase relatively slowly or depreciation to grow relatively rapidly or both. Between 1965 and 1970 depreciation allowances rose 55 percent; they jumped 72 percent in the next five years.[16] Clearly, then, depreciation has much to do with the divergence in the growth rates of net and gross investment.

At lower absolute levels, roughly the same general relations between growth of national income and that of net and gross fixed investment appear to have been set for the Tenth Plan as well, and it is possible that depreciation is again the factor of difference. A recent study of Soviet industrial investment suggests, indeed, that expectations with respect to depreciation may provide a clue to understanding the decision to reduce the national income share of net fixed investment (if that in fact was the case). Boris Rumer reports Soviet "growing interest" in the 1970s in Evsey Domar's 1950s growth model, particularly in that aspect that sees the possibility of maintaining the growth rate of national income even with a relative reduction of investment, so long as depreciation allowances exceed replacement requirements. Evidently, Soviet economists believed that in the USSR this difference was growing, thereby allowing planners to obtain at least stability in the growth rate of additions to fixed capital. In fact, Rumer argues, the relationship between depreciation and replacement was moving in the opposite direction. In any case, the accounting sheet increases in depreciation allowances were not matched by increases in real investment resources.[17]

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[14] For details, see Abraham S. Becker, Soviet National Income 1958–1964. National Accounts of the USSR in the Seven Year Plan Period, University of California Press, 1969, pp. 167–71, 189–92.

[15] Gosudarstvennyi piatiletnii plan..., p. 231; Narodnoe khoziaistvo SSSR v 1980 g, p. 345.

[16] Narodnoe khoziaisvo SSSR v 1980 g., p. 521.

[17] Boris Rumer, "The Dynamics of the Capital Coefficient of USSR Industrial Output: Investment Process in Soviet Industry," Final Report to the National Council for Soviet and East European Research, processed, no date, pp. 40–43.

Of course, the Ninth FYP was clearly different from the Tenth. The former intended (or pretended) to be "consumptionist;" the latter hardly bothered to make such a claim. Thus, the Ninth Plan explained the planned rise in the share of the consumption fund as "based on a significant growth in production of agriculture and consumer goods and also on a rise in the effectiveness of social production, enabling the achievement of high rates of economic development with a smaller share of the accumulation fund in the national income of the country." [18] At the 25th Party Congress which launched the Tenth Plan, Brezhnev declared: "The main thrust of the Party's economic strategy * * * is further augmentation of the economic might of the country, expansion and radical modernization of productive capacity, and ensuring of stable and balanced growth for heavy industry, the foundation of our economy." [19] And the cut in national income and investment growth in the Tenth Plan was much sharper than in the Ninth.

A feature common to both periods, however, was the attempt to offset investment growth cuts by structural redirection to decrease investment/output ratios. This was to be done by giving higher priority to reequipping existing enterprises than to building new enterprises. As Rumer notes: "The key idea of investment policy in the 1970s became to limit capital investment in the creation of new industral enterprises and to redirect investment resources to increase productive capacities through the reconstruction, expansion and modernization of existing enterprises." [20]

An additional factor that must be brought into consideration is the growing recognition by the leadership that there were substantial gaps between planned volumes of investment and the real resources available to meet those targets. It is probably "not by accident" that in Kosygin's 1979 article cited by Rush, the expression of satisfaction that national income was growing more rapidly than capital investment is followed by a reference to the problem of resource imbalance:

> At the same time, the next five year plan must achieve a better balance of capital investment with the possibilities of implementing it with material and labor resources, and provide means for the improvement of the organization of construction, the decrease of time required to equip construction projects and to insure commissioning of total capacities.[21]

This problem has long plagued Soviet planners, and it seems likely that no single factor explains the 1975 reduction in the planned rate of growth of investment better than the necessity to balance investment targets with resources available. At the same time, however, the leadership was apparently also acting out of a reluctance to cut deeply into faltering rates of growth of consumption. Thus, Rush is surely correct that the consequence of sustaining the pace of increase in military expenditure was in effect a reallocation of resources from investment to defense.[22]

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[18] Gosudarstvennyi piatiletnii plan..., p. 78.

[19] Cited in Gregory Grossman, "An Economy at Middle Age", Problems of Communism, 25:2, March-April 1976, p. 28.

[20] Rumer, "The Dynamics . . ." p. 10.

[21] A. N. Kosygin, "Kurs na effektivnost'—vazhneishee zveno ekonomicheskoi politiki partii," Planovoe khoziaistvo, 1979, No. 7, p. 11. Reviewing the fulfillment of the Ninth Plan, Gregory Grossman argued that despite the claim of precise fulfillment of the gross fixed investment goal, "it is highly doubtful that the target for real physical value of capital formation was ever approximately achieved." The paper fulfillment was "facilitated by chronic cost overruns, a problem that has attracted much attention in the Soviet press lately." Grossman, "An Economy at Middle Age," p. 24.

Rush also considers at some length the first question raised at the beginning of this overview: Why weren't the Soviet leaders interested in reducing military expenditure growth, during the heyday of detente, to promote economic growth? If they were aware of the low GNP (or national income) elasticity of military expenditures, cutting the military budget would not have seemed very productive. But I think Rush is correct in stressing strategic-political reasons.[23]

What of the future? Bond-Levine extrapolate a continued rise in the drain on machinery output from the accumulation of military weaponry, rising to as much as one-fifth of the total in 1985. This extrapolation is based on available information on Eleventh FYP (1981–85) magnitudes and appears to lend credence to the CIA claim that Soviet leaders apparently intend to maintain the two-decade old rate of increase in their military budget, despite current economic stringencies, at least for the next few years.

As already noted, it appears that cutting military expenditure growth is not a panacea for the Soviet economic dilemma. However, the military budget does impose a burden on the economy and the leadership may not be able to ignore that reality indefinitely. The investment growth provided for in the Eleventh FYP is so small as to endanger the fulfillment of output objectives. Hildebrandt's calculations with a multi-sector model indicate that maintenance of the posited rate of military buildup within an overall growth rate no higher than two percent means virtual stagnation in per capita consumption on the average in the 1980s. In view of the limitations of Western estimates of Soviet consumption as measures of goods and services actually available to the population—given the leakages from consumption flows into waste, spoilage, special distribution systems, theft and other second economy processes, etc., (measured) rates of increase of per capita consumption on the order of 0.2 percent per year in effect mean widespread shortages and selective deterioration of living standards of broad sections of the population. Soviet leaders are clearly aware of the connections between real consumption and labor productivity. It is not easy to gauge the likely political effects of such a consumption picture, prolonged over a decade or more. But it is difficult to believe that the Soviet leadership would not be deeply concerned at the prospect. In that situation, a gain of even 0.5 percentage point in the per capita consumption growth rate could appear politically significant.

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[22] For a time, at least, there need not have been a corresponding effect on the capital stock. The relation between changes in the rate of growth of investment and that of the capital stock depends on the size of investment relative to that of the stock at the moment of change as well as on the specific rates of change. Because the relative annual increment to the stock was then about 10 percent or less and because the capital stock growth rates had stabilized in the period 1965–1975 at roughly the rate of investment change, Soviet planners in the mid-70's could have expected that the decline in the rate of increase of the stock would, for a while, be considerably less than that in the rate of growth of investment. This is another reason, in addition to the planned restructuring of investment and the need to match plans with real resources available, why the cutback in investment growth might not have been regarded as incompatible with the basic growth strategy.

[23] My own assessment is given in Becker, The Burden of Soviet Defense: A Political-Economic Essay, R-2752-AF, The Rand Corp., October 1981, Section IV.

Should the next generation of Soviet leaders decide to bite the bullet (a metaphor that seems particularly appropriate here) and cut back on defense spending, the armed forces will have the comfort that any reduction in Soviet military power will surely be delayed and foreign perception of the change may also be slow in coming.[24] Nevertheless, despite this factor and the economic arguments for sharp change in Soviet resource allocation policy, the case for scepticism with respect to the likelihood of such change still seems strong. To be more than marginally useful, the cutback in the defense budget must be substantial and protracted. On that scale, it would threaten the cherished beliefs and fundamental interests of the most powerful groups in the society. Their opposition may yet be overcome, but one suspects that the economic picture will have to appear much bleaker in the Kremlin, and to a new set of leaders, before the struggle is undertaken.

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[24] Military power at any given time is a function of, among other things, the inventory of military assets—men, materials, equipment, structures—available at that point. Military expenditure is a flow that maintains and contributes gross additions to this inventory. In both of these components, changes in expenditure rates are likely to affect the stock with a time lag. This is particularly evident in comparing military investment (procurement and construction) with the military capital stock. A freeze on military investment at a base year level will see continued growth of the military capital stock, although at diminishing rates, of course. As for foreign perception of the change, in view of the secrecy surrounding all matters military in the USSR and the limitations of Western instruments of observation and detection, it would probably require sharp absolute reductions in defense resource allocations for the change to be detected without some delay. More moderate cutbacks might require a considerable time interval before the fact of decline could be established with confidence.

THE SOVIET MACHINERY BALANCE AND MILITARY DURABLES IN SOVMOD

By Daniel L. Bond and Herbert S. Levine * **

CONTENTS

	Page
Summary	296
I. Introduction	297
II. The Residual Method for Estimating Military Durables	299
III. Estimation Results for 1965-1980	306
IV. Comparison with the CIA Direct Cost Estimates	308
V. Sensitivity Analysis of the Residual Estimates	310
VI. Projections of the Machinery Balance to 1985	311
VII. Conclusion	313
Appendices	314
Bibliography	317

SUMMARY

In this paper, we discuss some of the work done on the defense expenditures component of the Wharton Soviet Econometric Model (SOVMD). Estimates of Soviet machinery balances for the period 1965 to 1980 are presented. From these balances residual estimates are derived of what is assumed to represent a portion of Soviet expenditures on military durables, most likely representing tactical and strategic weapons procurement. The estimated residual grew at an average annual rate of 12 percent over the fifteen year period, and it increased in size from 5 billion rubles in 1965 to 28 billion rubles by 1980 (in current prices). The residual was 9 percent of total machinery supply in 1965 and 15 percent by 1980. It is argued that these residual estimates are not inconsistent with the CIA's direct costing estimates of Soviet defense spending. However, there is a considerable range of possible error in our calculation of the machinery balance, especially in years for which input-output based data are not available. Projections of the machinery balance to 1985, in part based on information from the Soviet 11th Five Year Plan, provide some support for the view generally held in the West that the Soviet Union plans to maintain its current rate of growth of military procurement, even though with slower growth of the machine building sector this means less machinery will be available for non-defense end-uses.

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I. INTRODUCTION

Various aspects of the Wharton Soviet Econometric Model (SOVMOD) and its development have been described in previous Joint Economic Committee compendiums on the Soviet Union.[1] In the present paper, we discuss some of the work we have done on the defense expenditures component of the model and certain critical problems associated with it.

Needless to say, interest in the measurement of Soviet defense expenditures remains high. As the U.S. and the Soviet Union enter into a new round of negotiations on arms controls, there are important questions as to the role that defense spending has played in the recent slow-down of Soviet economic growth and the ability of the Soviet economy to support various levels of defense spending in the future. Also, with an increased willingness in Washington to use economic policy in an attempt to influence Soviet behavior, there are questions as to the possible impact on Soviet defense spending the West might have through control of Western trade and credits.

Given Soviet secrecy about almost all aspects of their defense industry, and its role in their economy, these are difficult questions for Western analysts to answer. Central to any discussion of these issues is the problem of measuring Soviet defense expenditures and the share of Soviet resources going into the defense sector. Although there has been considerable work on this topic, it is still a subject of much debate. (A recent summary of past efforts is provided in Becker (1981).)

In this paper we present estimates for one of the important components of Soviet defense expenditures—military durables—for the period 1965–1980. Projections of possible future rates of growth of military durables to 1985, based on information available from the Soviet 11th Five Year Plan, are also presented. The estimation approach used here derives from the pioneering work of William Lee (see Lee (1977)) and Stanley Cohn (see Cohn 1978)). It involves subtracting from the output of the Soviet machine building industry all identifiable non-defense uses of machinery to obtain a "residual" that is assumed to be the machinery and equipment employed for military purposes—thus, the use of the label "residual method" for identifying this estimation technique.[2]

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[1] See Green, et al. (1976) and Bond and Levine (1979). SOVMOD was originally developed in the early 1970s at the University of Pennsylvania by Donald W. Green and Christopher Higgins and a joint SRI International/Wharton Econometric Forecasting Associates team. (See Green and Higgins (1977).) Since 1980 work on the model has been conducted by Wharton's Centrally Planned Economies Projects group in Washington under the direction of Daniel L. Bond.

[2] Since both Lee and Cohn have presented their estimates elsewhere, it is necessary to justify going through these calculations once again. Although the estimates of military durables presented here are quite close to those obtained by Cohn (1978), and the method, assumptions and data used in most cases are the same as those used by him, it seems useful to repeat his efforts here because Cohn's original work had limited circulation (as it appeared only in an unpublished informal note) and his estimates covered the period only up through 1975.

Lee's estimates have been published in several sources (Lee 1977, 1979 and CIA Estimates, 1980) and have been updated through 1980. However, the fact that the results presented here differ significantly from his warrants their consideration. While Lee's estimates indicate a very high, and accelerating, rate of growth of defense spending, the estimates presented here indicate a lower and steady rate of growth. Also, Lee's assertion that importation of machinery from the West has played a vital role in the last few years in allowing the Soviet Union to maintain their arms build-up is examined critically. Finally, what Lee finds to be an apparent inconsistency

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A key characteristic of this method is that it relies exclusively on data from openly available Soviet publications. The primary sources used are the official Soviet statistical yearbook and foreign trade handbook, and also Western reconstructions of the 1966 and 1972 Soviet input-output accounts. The latter provide a considerable amount of data not directly available from Soviet publications, but the estimates needed to reconstruct the accounts are based on information found in Soviet sources.

There are both advantages and disadvantages in using this approach to identify military durables. The primary advantages, and the ones that motivated the effort for the authors, is that this method allows one to embody within an econometric model the static trade-offs between military and non-military uses of machinery. And it provides a starting point for examining the dynamic impacts, through the investment cycle, on the entire Soviet economy. The authors have recently completed several studies in which such analyses have been carried out using a variant of SOVMOD incorporating a machinery balance such as that described in this paper. (See Bond and Levine, 1982a, 1982b.)

The great disadvantages of the residual method for estimating Soviet military durables, it must be acknowledged, are the very large degree of possible error arising in the calculation of the residual, and the uncertainty as to the content of the residual. As will be discussed below, errors could arise in the calculation of all the entries in the balance, and these errors could have a cumulative impact on the residual estimate. Also, we cannot be certain that the residual contains only, or all, machinery output used for military purposes. The entire approach is based on the assumption that the Soviets, in an attempt to hide information on their military spending, have not published information directly related to most military durables, but that their published statistics do identify all non-military uses of machinery. These are rather strong assumptions. Clearly, the CIA method of "direct costing" is a more reliable way of estimating Soviet defense expenditures, but it is not an approach regularly open to academic scholars, given the classified nature of some of the inputs into the direct costing method (and the unfortunate recent CIA policy of curtailing the flow of its research results to the outside scholarly community). The fact, however, that the residuals, as we have calculated them, do not appear unreasonable in their size, rate of growth, or relation to other components of the model, and that they appear not to be inconsistent with the results obtained by the CIA using the direct costing method, has increased our confidence in them. On balance, we feel that the identification of the residual in the machinery balance provides a useful, though admittedly crude, method for identifying the place of military spending in a key sector (machine building and metal working) of the Soviet economy.

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between results obtained using the residual method and the results obtained by the CIA using the major alternative estimation approach—the so-called "direct costing method"—is not supported by the estimates presented in this paper.

II. The Residual Method for Estimating Military Durables

The residual method for estimating Soviet military durables is described in detail in Lee (1977) and Cohn (1978); only a summary presentation will be made here. The basic assumption of the method is that military durables can be estimated by subtracting all identified non-military uses of machinery (and equipment) from the value of total machinery production. Thus, in order to estimate the value of military durables it is necessary to identify all the remaining elements in what can be called the machinery balance. This balance can be depicted as follows: (Note that we explicity identify both domestic and foreign sources and uses of machinery for defense purposes; in the previous studies by Lee and Cohn the role of arms trade in the machinery balance was not clearly spelled out).

Gross value of output of the Soviet machine building sector	MB GVO
minus	–
Use of machinery as an intermediate product in the Soviet economy	MB ID
minus	–
Soviet domestic use of machinery for consumer durables	MB CD
minus	–
Soviet domestic use of machinery for producer durables (i.e., machinery and equipment component of investment)	MB PD
plus	+
Soviet imports of machinery and arms	M&A IM
minus	–
Soviet exports of machinery and arms	M&A EX
equals	=
A residual which is assumed to represent some portion of the Soviet military's use of machinery (supply of military machinery)	MB MD

It should be emphasized that the estimated residual probably does not include all use of machinery by the Soviet military. A study released by the CIA (1978a) indicates that there is evidence that some of the reported volume of investment includes military uses. This study states:

> Defense purchases a considerable volume of items commonly used in civilian activities. These items, which would be considered part of investment in the civilian sphere, include trucks, cars, cranes, forklifts, transport ships and aircraft, and organizational equipment. Direct cost estimates of these purchases in 1970 range from 2.5 billion to 4.5 billion rubles. Soviet publications dealing with investment, though somewhat ambiguous, seem to imply that such expenditures are reported as investment. (pp. 11–12).

Thus the residual probably covers those items produced by the machine building sector which have an exclusively military purpose—battleships, fighter aircraft, field arms, artillery, missiles, etc. This is an important point that has not been made clear in earlier studies. Not only does it mean that the estimate of military durables obtained by the residual method is only a part of total military durables, but that we can perhaps identify the residual with a specific component of military durables—tactical and strategic weapons.

Many problems arise when one attempts to construct the machinery balance from Soviet data. Published statistics provide information on all the entries in the chain listed above (except the residual). But these data are not in a form which allows direct comparability across entries. Thus a considerable amount of estimation and adjustment for differences in pricing and coverage is required in order to prepare a balance from which a usable residual estimate of military durables can be obtained. The problems faced in making these adjustments are discussed in detail in the Lee and Cohn references, and only essential comments related to the estimates presented here will be made in the following discussion.

As has been pointed out elsewhere (CIA, 1978a):

> The pitfalls of the residual estimates are well known: any error in any estimate will create an error in the residual, which will always contain other small components beside that being measured. Thus, a large error range must be given to any residual estimate unless high confidence can be given to each other entry in the calculation. (p. 8)

Unfortunately, high confidence can not be given to any of the entries in the estimated Soviet machinery balance. Therefore, the residual estimate of military durables is susceptible to a high degree of error. This will be discussed further in a later section of the paper.

Table 1 provides a complete set of estimates for the construction of Soviet machinery balance for the period 1965–1980. (The projections for 1985 included in the table are discussed in a later section of this paper.) The table is organized so as to correspond to the sequence of entries in the machinery balance as given above, but there are numerous intervening entries required to document the estimation process. The footnotes to the table detail the relationships between columns and specific data sources, while the following sections provide more general commentary on each step of the estimation process.

The final entries in the machinery balance are all in current producers' prices. Producers' prices are normally the preferred measure as they are net of the trade and distribution costs and taxes which are included in purchasers' figures. Fortunately, the 1966 and 1972 input-output tables are available in both sets of prices, and this makes it possible to estimate conversion coefficients where needed. (The input-output data are described in Appendix A of this paper.) Current prices are used primarily because the input-output control figures are in current prices.

DERIVATION OF THE GROSS VALUE OF OUTPUT OF THE MACHINE BUILDING SECTOR

Time series data on the value of output of the Soviet machinery sector (MB GVO) in current producers' prices are not available from official Soviet sources.[3] However, output indexes (based on

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[3] In the balances presented here the term machine building sector (or simply machinery sector) refers to those branches of industry which produce all forms of machinery and equipment, cable products, electronic products, machine tools, precision instruments, transportation vehicles and equipment, agricultural and construction equipment. (Metal wares and structures and repair of machinery and equipment are not included since they would not provide inputs into military durables, but rather military construction and maintenance.) In the Soviet input-

Continued

values measured in what the Soviets label constant prices of various years) are published in the annual statistical handbooks (col. 1). A composite index of MB GVO for 1965–1980 (in 1972 purchasers' prices) was estimated by linking the published indexes (col. 2). This index was then used together with benchmark 1966 and 1972 absolute values of machinery output obtained from the input-output tables to estimate values for the full time series.

TABLE 1.—THE SOVIET MACHINERY BALANCE

	MB GVO index (1)	MG GVO 1972 pr (2)	MB GVO i/o data (3)	MG GVO deflator (4)	MG GVO cur pro pr (5)	MG ID i/o data (6)
1965	0.46	38.40		1.14	43.66	
1966	.51	43.11	47.89	1.11	47.89	20.33
1967	.57	47.83		1.09	52.32	
1968	.64	53.89		1.07	57.71	
1969	.72	60.62		1.05	63.84	
1970	.80	67.36		1.03	69.58	
1971	.90	75.44		1.02	76.65	
1972	1.00	84.20	84.20	1.00	84.20	38.20
1973	1.13	94.98		.99	94.03	
1974	1.26	106.43		.98	104.30	
1975	1.42	119.23		.97	116.01	
1976	1.56	131.35		.97	126.75	
1977	1.70	143.48		.96	137.59	
1978	1.86	156.95		.96	150.04	
1979	2.02	169.75		.95	161.77	
1980	2.14	180.52		.95	171.68	
1985 L	2.79	234.68		.94	221.31	
1985 H	3.00	252.73		.94	238.33	

	MB ID/GVO ratio (7)	MG ID cur pro pr (8)	MB CD retail pr (9)	MG CD i/o data (10)	MG CD deflator (11)	MG CD cur pro pr (12)
1965	0.42	18.25	4.02		0.87	3.48
1966	.42	20.31	4.57	3.78	.83	3.78
1967	.43	22.45	5.09		.80	4.05
1968	.44	25.16	5.81		.76	4.43
1969	.44	28.09	6.36		.73	4.65
1970	.45	30.96	7.09		.70	4.97
1971	.45	34.49	7.90		.68	5.33
1972	.46	38.23	9.77	6.35	.65	6.35
1973	.46	42.88	11.13		.64	7.06

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output accounts these branches are covered by sectors 15–43 (using the 110-sector nomenclature). (See Treml, et al. (1972) for a detailed description.) It is assumed that the production of most military durables are included together with civilian production in the statistics for these sectors.

An additional likely source of machinery for the military is the sector identified as "industry, not elsewhere classified". This sector includes branches of industry producing machinery, but also a wide assortment of those not producing machinery. (Treml, et al., 1972, p. 118) In order to define an upper limit on his residual estimates, Cohn (1978) includes the final demand of this sector in an alternative set of balance calculations. This was not done here. Since industry n.e.c. is a residual category itself, there is considerable uncertainty as to the value of the non-military final demand components. In the reconstructed producers' prices input-output tables the estimated values of final demand minus consumption for industry n.e.c. are −0.415 for 1966 and .560 for 1972. Thus the addition of these amounts would not greatly alter the MB MD estimates. Also, it is unlikely that an industry n.e.c. residual would contain the same type of military durables as the MB residual (tactical and strategic arms), and this would cloud the interpretation of the results.

	MB ID/GVO ratio (7)	MG ID cur pro pr (8)	MB CD retail pr (9)	MG CD i/o data (10)	MG CD deflator (11)	MG CD cur pro pr (12)
1974	.46	47.77	12.83		.62	7.94
1975	.46	53.48	14.29		.61	8.68
1976	.46	58.69	15.27		.60	9.12
1977	.47	63.98	16.76		.59	9.82
1978	.47	69.92	18.13		.58	10.54
1979	.47	75.55	18.45		.58	10.63
1980	.47	80.17	20.15		.57	11.55
1985 L	.47	103.79	26.97		.56	15.10
1985 H	.47	111.78	25.72		.56	14.40

	MB PD con 69 pr (13)	MB PD index (69) (14)	MB PD cur pur pr (15)	pro/pur pr adj (16)	MB PD cur pro pr (17)	West Mach imports (dollars) (18)
1965	19.30	0.97	18.64	0.95	17.83	0.51
1966	20.80	.99	20.63	.96	19.77	.56
1967	22.50	.99	22.32	.96	21.47	.67
1968	23.50	.99	23.31	.96	22.50	.90
1969	26.40	1.00	26.40	.96	25.57	1.12
1970	27.80	1.01	28.05	.97	27.22	1.11
1971	30.10	.98	29.47	.97	28.64	1.04
1972	32.50	.99	32.14	.97	31.31	1.36
1973	35.60	.94	33.43	.97	32.61	1.95
1974	40.20	.95	38.15	.97	37.27	2.56
1975	44.10	.95	41.85	.97	40.95	5.00
1976	46.60	.96	44.64	.97	43.74	5.83
1977	50.60	.97	48.98	.98	48.03	6.19
1978	52.40	.98	51.25	.98	50.33	7.09
1979	54.40	.99	54.02	.98	53.05	6.94
1980	56.30	1.01	56.75	.98	55.73	7.14
1985 L	63.06	1.09	68.42	.98	66.84	
1985 H	61.93	1.09	67.19	.98	65.65	

	Ruble/dollar ex rate (19)	East Mach imports (rubles) (20)	East Arms imports (rubles) (21)	East M+A imports (rubles) (22)	Total M+A imports (rubles) (23)	West Mach exports (dollars) (24)
1965	0.90	1.96	0.21	2.17	2.63	0.51
1966	.90	1.80	.19	2.00	2.50	.48
1967	.90	2.02	.20	2.22	2.83	.50
1968	.90	2.32	.21	2.53	3.34	.53
1969	.90	2.48	.22	2.70	3.71	.69
1970	.90	2.71	.26	2.97	3.96	.77
1971	.90	2.83	.28	3.11	4.04	.78
1972	.83	3.42	.36	3.78	4.91	.91
1973	.74	3.84	.44	4.28	5.71	1.18
1974	.76	4.90	.48	5.38	7.31	1.12
1975	.72	5.35	.46	5.81	9.41	1.48
1976	.75	5.99	.64	6.63	11.02	1.62
1977	.74	6.94	.79	7.73	12.29	1.78
1978	.68	9.64	.93	10.57	15.42	2.21
1979	.66	9.75	.90	10.65	15.20	2.65
1980	.65	10.32	.79	11.11	15.75	2.68
1985 L						
1985 H						

	West Arms exports (dollars) (25)	West M+A exports (dollars) (26)	East Mach exports (rubles) (27)	East Arms exports (rubles) (28)	East M+A exports (rubles) (29)	Total M+A exports (rubles) (30)
1965	0.29	0.80	1.02	0.61	1.62	2.34
1966	.41	.89	1.22	.56	1.78	2.58
1967	.44	.94	1.38	.58	1.96	2.80
1968	.53	1.07	1.59	.70	2.29	3.25
1969	.60	1.29	1.74	.70	2.44	3.60
1970	.90	1.67	1.79	.77	2.56	4.06
1971	.79	1.57	2.01	.78	2.80	4.21
1972	1.17	2.08	2.27	.71	2.98	4.70
1973	2.35	3.53	2.62	.77	3.39	5.99
1974	2.22	3.34	3.15	.88	4.03	6.56
1975	2.25	3.73	3.44	1.12	4.56	7.25
1976	2.69	4.31	4.25	1.23	5.48	8.73
1977	4.53	6.31	4.97	1.46	6.43	11.09
1978	5.40	7.61	5.53	1.87	7.40	12.59
1979	5.63	8.28	5.75	2.12	7.88	13.30
1980	5.68	8.36	6.16	2.20	8.36	13.79
1985 L						
1985 H						

	M+A import i/o data (31)	Con coef M imports (32)	M+A export i/o data (33)	Con coef M exports (34)	M+A imports dom pr (35)	M+A exports dom pr (36)
1965		0.62		0.39	1.63	0.91
1966	1.54	.62	1.01	.39	1.54	1.01
1967		.76		.59	2.15	1.65
1968		.90		.79	3.00	2.56
1969		.90		.79	3.34	2.85
1970		.90		.79	3.57	3.21
1971		.90		.79	3.64	3.32
1972	4.42	.90	3.73	.79	4.42	3.73
1973		.90		.79	5.14	4.73
1974		.90		.79	6.58	5.18
1975		.90		.79	8.47	5.73
1976		.90		.79	9.92	6.89
1977		.90		.79	11.06	8.76
1978		.90		.79	13.88	9.95
1979		.90		.79	13.68	10.51
1980		.90		.79	14.17	10.89
1985 L						
1985 H						

	M trade balance (37)	Total Mach supply (38)	Total Mach civ demand (39)	MB MD cur pro pr (40)
1965	−.72	45.29	40.47	4.82
1966	−.53	49.44	44.88	4.56
1967	−.49	54.47	49.62	4.85
1968	−.44	60.72	54.66	6.06
1969	−.49	67.18	61.16	6.02
1970	−.36	73.14	66.35	6.79
1971	−.31	80.29	71.80	8.49
1972	−.69	88.62	79.62	9.00
1973	−.41	99.17	87.28	11.89
1974	−1.40	110.88	98.16	12.72
1975	−2.74	124.48	108.83	15.65
1976	−3.02	136.67	118.44	18.23
1977	−2.31	148.65	130.59	18.06
1978	−3.93	163.92	140.74	23.18
1979	−3.17	175.45	149.74	25.71
1980	−3.28	185.86	158.35	27.51
1985 L	−3.00			38.57
1985 H	−6.00			52.50

Notes to column in table 1:

(1) Machine Building Gross Value of Output Index. Calculated from machine building (constant price) output indexes published in Narodnoe Khoziaistvo SSR, various years.

(2) Machine Building Gross Value of Output in 1972 Prices. Column (1) times the 1972 input/output value of MB GVO in column (3). (Calculations were made with unrounded figures.)

(3) Machine Building Gross Value of Output from Input/Output Data. Obtained from the 1966 and 1972 producers' prices input-output tables. (See Appendix A.)

(4) Machine Building Gross Value of Output Deflator. For benchmark years—1966 and 1972—column (3) divided by column (2). For other years index interpolated between, or extrapolated beyond, benchmark values as described in Appendix B.

(5) Machine Building Gross Value of Output in Current Producer Prices. Column (5) times column (4).

(6) Machine Building Intermediate Deliveries from Input/Output Data. Obtained from 1966 and 1972 producers' prices input-output tables. (See Appendix A.)

(7) Machine Building Intermediate Demand to GVO Ratio. For benchmark years column (6) divided by column (5). For other years index interpolated between or extrapolated beyond, benchmark values as described in Appendix B.

(8) Machine Building Intermediate Demand in Current Producers' Prices. Column (2) times column (7).

(9) Machine Building Consumer's Durables in Retail Prices. Estimated as described in Appendix C.

(10) Machine Building Consumer's Durables from Input/Output Data. Obtained from 1966 and 1972 producers' prices input-output tables. (See Appendix A.)

(11) Machine Building Consumer's Durables Deflator. For benchmark years—1966 and 1972—column (10) divided by column (9). For other years index interpolated between, or extrapolated beyond, benchmark values as described in Appendix B.

(12) Machine Building Consumer's Durables in Current Producers' Prices. Column (9) times column (11).

(13) Machine Building Producer Durables in Constant 1969 Prices. Chain linked series for investment in machinery and equipment published in Narodnoe Khoziaistvo SSR, various years, lagged one year and increased by 4.5 percent, Stanley Cohn's correction factor for omitted equipment investment in state institutions, schools, hospitals and nurseries.

(14) Machine Building Producer Durables Price Index (1969 = 1.00). See Appendix D for description.

(15) Machine Building Producer Durables in Current Purchasers' Prices. Column (13) times column (14).

(16) Producers'/Purchasers' Price Adjustment. Coefficients for converting the values in column (16) from purchasers' to producers' prices were estimated for 1966 and 1972 as the ratio of non-consumption final demand for machinery in both prices. (See Appendix A). Values for other years were estimated using the function described in Appendix B.

(17) Machine Building Producer Durables in Current Producers' Prices. Column (16) times column (15) plus a correction for the import component of producer durables which are already included in producers' prices. (The latter is calculated as 1 minus column (16) times column (23) times column (32)).

(18) Western Machinery Imports in Dollars. Based on official Soviet trade statistics on trade with the capitalist countries compiled by Jan Vanous. (Wharton, 1982, is the source for entries in columns (18)-(30).)

(19) Ruble/Dollar Exchange Rate. This is the official exchange rate.

(20) Eastern Machinery Imports. Ruble value of Soviet imports from socialist countries.

(21) Eastern Arms Imports. Estimates of Soviet arms imports from the socialist countries were prepared by Jan Vanous. These and other estimates of arms trade were calculated by subtracting the sum of reported trade with individual countries included in the official Soviet foreign trade statistics from reported trade totals, on the assumption that most of the unreported commodity trade is arms. This technique has been corroborated by other sources of information. See Vanous (1981).

(22) Eastern Machinery and Arms Imports. Column (20) plus (21).

(23) Total Machinery and Arms Imports. Column (18) times column (19) plus column (22).

(24) Western Machinery Exports in Dollars.

(25) Western Arms Exports in Dollars.

(26) Western Machinery and Arms Exports in Dollars. Column (24) plus column (25).

(27) Eastern Machinery Exports.

(28) Eastern Arms Exports.

(29) Eastern Machinery and Arms Exports. Column (27) plus column (28).

(30) Total Machinery and Arms Exports. Column (26) times column (19) plus column (29).

(31) Machinery and Arms Imports from Input/Output Data. See Appendix A.

(32) Conversion coefficients for Machinery Imports. For 1966 and 1972, column (31) divided by column (23). Based on the discussion in Treml and Kostinsky (1982), it was assumed that a change in conversion coefficients occurred in mid-1967 and that they remained relatively constant thereafter.

(33) Machinery and Arms Exports from Input/Output Data. See Appendix A.

(34) Conversion coefficients for Machinery Exports. For 1966 and 1972, column (33) divided by column (30).

(35) Machinery and Arms Imports in Domestic Producer Prices. Column (23) times column (32).

(36) Machinery and Arms Exports in Domestic Producer Prices. Column (30) times column (34).

(37) Machinery Trade Balance. Column (36) minus column (35).

(38) Total Machinery Supply. Domestic machinery production, column (5), plus machinery imports, column (23), times column (32).

(39) Total Machinery Civilian Demand. Machinery intermediate demand, column (8), plus consumer durables, column (12), plus producer durables, column (17), plus exports, column (30), times column (34).

(40) Machinery Building Military Durables in Current Producers' Prices. Column (38) minus column (39).

USE OF MACHINERY AS AN INTERMEDIATE PRODUCT

In order to estimate the volume of machinery used as an intermediate product in the domestic economy (MB ID), it was necessary to rely on the value of MB ID obtained from the input-output accounts for 1966 and 1972 (col. 6), and relate this to MB GVO for those years. Ratios for other years were interpolated or extrapolated from these benchmarks using annually published data on the cost of material inputs in the MB sector (col. 7). (The details of this last step are discussed in Appendix B.)

FINAL DEMAND FOR CONSUMER DURABLES

Time series data on retail sales of key consumer durables produced by the MB sector (col. 9) were used to link and extend the input-output derived values for consumption of machinery to develop a series of machinery used as consumer durables, in current producers' prices (col. 12). The retail sales data are presented in Appendix C.

PRODUCER DURABLES DEMAND

Official time series of machinery and equipment component of investment (in constant prices of various years) (col. 13) were used to estimate values for machinery used as producer durables (in current purchasers' prices) (col. 15). The investment data were lagged and adjusted for omitted equipment investment in certain service sectors in accordance with the arguments presented by Cohn (1978). The price index used to convert this series to current purchasers' prices (col. 14) is described in Appendix D. A final adjustment was required to convert the value of the domestic supply of producer durables from a purchaser price to producer price basis (col. 17). (The value of imported machinery is adjusted to producers' prices separately.) Following Cohn's lead, conversion coefficients derived from the 1966 and 1972 reconstructed input-ouput tables were used for this purpose (col. 16).

MACHINERY AND ARMS IMPORTS AND EXPORTS

Time series of machinery exports and imports in foreign trade prices and official ruble/dollar exchange rates were obtained from Soviet trade handbooks (cols. 18–30). The volume of arms trade was estimated by Jan Vanous (Wharton 1982) and is an estimate based on the "unspecified residuals" in the official foreign trade statistics. (The estimates of machinery trade made by Treml and Kostinsky (1982) for the 1972 input-ouput account match closely those of Vanous. Also, the estimate of the sum of arms exports for the period 1975–77 made by Vanous closely matches that given by the CIA in CIA (1978 c), p. ii.) Conversion coefficients linking the 1966 and 1972 input-ouput benchmark estimates to the time series of trade data (col. 19) were used to convert the latter from foreign trade prices to domestic prices for other years, on the assumption that the major change in conversion rates occured in mid-1967.

ESTIMATION OF MILITARY DURABLES AS A RESIDUAL

The final step in the estimation of military durables (col. 40) was to subtract the identified civilian uses of machinery (col. 39) from total machinery supply (production and imports) (col. 38). The machinery balance equation described above was used for this purpose.

III. ESTIMATION RESULTS FOR 1965-80

The final residual estimates (shown in column 40 of Table 1) should be viewed as only a crude approximation to the possible amount of machinery used by the Soviet military. The residual grew by approximately 12 percent per year between 1966 and 1972, banchmark years for which the most information is available. Growth over the period 1972 to 1980 was somewhat higher, averaging 15 percent per year. (The year to year variations in the residual should be ignored since the annual variability of the estimates are quite sensitive to a number of tenuous assumptions used in the calculations—especially the assumed investment lags used for estimating producer durables.)

As a share of total domestic machinery production, the residual rose slightly, from 10 percent to 11 percent, between the benchmark years, 1966 and 1972, and gradually increased after 1972 to 16 percent in 1980. As a share of total machinery supply (domestic production plus imports) the residual's share increased from 9 percent to 10 percent between 1966 and 1972, and to 15 percent by 1980. During the same period there has been a rather steady decline in the share of Soviet machinery production used as both producer durables (dropping from 41 percent in 1966 to 33 percent in 1980) and consumer durables (8 percent to 7 percent).

Table 1 also provides some interesting insights into the role of Soviet machinery trade in the total machinery balance. As a share of domestic machinery supply, total machinery imports grow from 4 percent in 1966 to 5 percent in 1972, and then to 8 percent in 1980 (see Table 2). At the same time machinery exports also increased to where they represented over 6 percent of domestic production by 1980—with arms exports alone perhaps accounting for over half of this amount. Although by importing machinery the Soviets may have relieved some of the pressure of competing demands on the domestic machine building industry (as indicated by the net import balance), the major result has been to allow them to pursue greater specialization in machinery production, and thus develop additional machinery export capacity. Since one direction of Soviet specialization appears to be toward arms production, as indicated by the rapid increase in arms exports, this has perhaps helped to lower production costs for the Soviet's own military durables.[4]

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[4] William Lee (1977) has made a much stronger argument that machinery imports in the decade of the 1970s have allowed the Soviets to maintain an arms buildup that they would have otherwise been unable to support given their own domestic production capabilities. Not only do the estimates in Table 1 show a much lower quantitative role of machinery imports relative to domestic machinery production than do Lee's, but Lee neglects to note that machinery exports grew only slightly slower than imports during the 1970's—and considerably faster from 1975 to 1980. Unless one includes Soviet arms exports as part of Soviet military durables, these trends would appear to argue against Lee's interpretation.

Currently there is great interest in evaluating the degree of economic leverage the West may be able to exercise by controlling its machinery trade with the Soviet Union. In this regard it should be noted that the figures just discussed are for total Soviet trade, not just trade with the West. Table 2 also provides some indicators on the relationship between Soviet imports of machinery from the West (almost all of which come from the developed industrial economies and consist primarily of producer durables) and other components of the machinery balance. The figures in this table show that the Western share of machinery imports has fluctuated significantly, increasing between 1965 and 1969 and 1972 and 1976, and reaching a peak at 40 percent of total machinery imports in 1976. The share declined between 1969 and 1972 and in the post-1976 period. Even at their peak in 1976, Western machinery imports accounted for only 3 percent of the total supply of machinery in the Soviet Union (production plus net imports). Comparing the volume of Western machinery to its most likely direct use—as producer durables—the share reached 10 percent in 1976 and declined thereafter. The U.S. share of Soviet machinery imports from the West is given in column 5 of Table 2. At its height in 1976, it was 14 percent, and in 1980 it was 7 percent. Thus, normally the U.S. accounted for considerably less then 1 percent of the Soviet machinery supply and of the machinery component of Soviet investment.

TABLE 2.—SHARES OF MACHINERY IMPORTS IN THE SOVIET ECONOMY

[In percent]

	Share of total machinery imports in total machinery supply	Share of machinery imports from the West in total machinery imports	Share of machinery imports from the West in total machinery supply	Share of machinery imports in machinery component of domestic investment	Share of machinery imports from the US in machinery imports from the West
1965	4	17	1	3	1
1966	3	20	1	3	1
1967	4	21	1	3	1
1968	5	24	1	4	1
1969	5	27	1	4	3
1970	5	25	1	4	2
1971	5	23	1	3	3
1972	5	23	1	4	4
1973	5	25	1	4	12
1974	6	26	2	5	10
1975	7	38	3	9	13
1976	8	40	3	10	14
1977	7	37	3	10	8
1978	9	31	3	10	6
1979	8	30	3	9	7
1980	8	29	2	8	7

Source: Estimates in table 1.

It would be misleading to use these aggregate indicators as a measure of the dependency of the Soviet Union on machinery imports from the West. They do give, however, some indication as to the extent of reallocation of machinery among alternative uses that would be required if the Soviets were to be cut off from Western supplies. Since, at most, only three percent of total machinery supply would be affected, it appears likely that the Soviets could, by changing their pattern of domestic use and trade, shield priority uses such as domestic investment or military durables procurement from significant impact. Also, since most of these imports are currently used as producer durables, the full impact of an embargo of machinery trade would not be immediate. It would appear over time in delays in completion of investment projects; and, to the extent that the substituted machinery (domestically produced or imported from the socialist countries) was of lower quality than Western machinery, it would appear in lower quantity and/or quality of output.

IV. Comparison With the CIA Direct Cost Estimates

It is useful to compare the estimates of military durables produced here with the estimates of military expenditures prepared by the CIA using the direct costing approach.

The only published figure on defense-related machinery purchases based on the CIA's direct cost estimates, indicate that such purchases were in the range of 13 to 21 billion rubles in 1970. (CIA, 1978a, p. 14) In order to compare the 1970 level of the residual calculated here, which is 6.8 billion rubles, to the CIA figure, we must add to the residual certain categories of military machinery not included in it. The above noted 2.5 to 4.5 billion of reported investment which is used by the military is one such category. At least the following would also have be added: machinery produced by the input-output sector "industry, not elsewhere classified" which goes to the Soviet military, and machinery used in capital repair of any military equipment. Assuming that half of "industry n.e.c." final product goes for defense, and that around one-fifth of capital repair is for the military gives a very crude estimates of 5 to 10 billion rubles. All of these have been included in the CIA estimate, and could account for the remaining differences in the estimates. (CIA 1978a, p. 14) Obviously this comparison does not provide a clear measure of the degree of correspondence of the residual estimate and the direct costing estimate for military durables, but it does indicate that the two are not inconsistent. Unfortunately, the very broad definition assigned by the CIA to military durables, and the absence of any detailed breakdown of components, make further refinement of the comparison impossible.[5]

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[5] Since the residual estimates prepared by William Lee have been used as evidence that the CIA defense spending estimates are low, it is useful to compare Lee's results with those obtained in this study. The comparison is made below for the two years for which the most reliable information is available, the input-output benchmark years 1966 and 1972.

	1966		1972	
	Lee (1977)	This study	Lee (1977)	This study
MB GVO	48.0	47.9	95.0	84.2
MB ID	18.1–19.1	20.3	35.9–37.8	38.2
MB CD	2.6	6.4	4.9	6.4
MB PD	19.1	19.8	29.5	31.3
MB&A IM	1.6	1.5	3.3	4.4
MB&A EX	1.2	1.0	2.1	3.7
MB MD	7.6–8.6	4.6	24.0–25.9	9.0

It should be noted that the final versions of the 1966 and 1972 input-output tables in producers' prices were not available to Lee when he prepared his 1977 book, and this is one source of the differences in the estimates. However, in his more recent presentations (1979 and 1980), Lee's estimates of the residual surprisingly have changed very little. It is not apparent why the

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For growth rate comparisons, the only published information available on the CIA estimates is that total defense spending grew at approximately 4 percent to 5 percent per year in constant prices over the period from the mid-1960s to the late 1970s and that Soviet military investment "showed an upward trend but displayed cycles in annual growth rates that were related to the phasing of major procurement programs". (CIA, 1982) It has been suggested by Becker (1981, p. 69, fn. 19) that a conservative rate of price inflation for the CIA defense expenditures would be two percent per year. Another study (Doe, 1982) found evidence that price inflation for products of the machinebuilding sector was 2 percent to 4 percent over this period. Thus, the CIA estimated rate of growth for total defense spending in current prices would be perhaps 6-9 percent per year. The estimated residual's growth is twice this rate. But the residual relates, of course, only to procurement, and procurement grows more rapidly than total defense expenditures. Furthermore, since the residual is relatively small in relation to the CIA estimate of total defense spending, this difference in growth rates is not by itself evidence of inconsistency. If we take the CIA's estimate that total defense spending in 1970 was in the range of 40 to 50 billion rubles, the residual's share would have been 13 percent-19 percent of total defense spending in 1965, growing to 14 percent-17 percent in 1970 and to no more than 23 percent-38 percent in 1980.[6] As noted above, the residual represents only a portion of military durables, and probably that portion—tactical and strategic weapons—which has undergone the most rapid rate of real growth in this period, and perhaps a higher than average rate of price inflation also.[7]

Our estimate of the residual for 1970 can be shown to be consistent with the CIA's estimate of total Soviet defense spending in 1970. To make this comparison it is necessary to add other categories of military expenses to the residual estimate of military durables. The other major categories of expenditures are: other military machinery, operations and maintenance expenditures (which include expenditures for military manpower), military construction and defense research and development.

Rough estimates can be made for 1970 as follows. The category of "other military machinery" includes the 2.5 to 4.5 billion of reported investment plus some portion of military machinery from indus-

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difference should be so large when the techniques used for estimating the residual are almost identical. (Cohn presents an evaluation of Lee's estimates in his 1978 paper.)

The divergence in the two sets of estimates grows even greater after 1972. The Lee estimate of MB MD for 1980 is 67-75 billion rubles (Lee, 1980, p. 24) compared to 27.5 billion estimated in this paper. (Lee gives his estimates in constant 1970 prices, but states that there is little difference between the current price and constant price measures. He in fact uses the two measures interchangeably in many places in his work.)

It is not possible to discuss here all the sources of these differences. However, as the presentation on sensitivity analysis in this paper shows, a critical difference may be the way various correction factors were projected after 1972. In any case, the substantial differences between our residual estimates and those of Lee are a matter of concern to us.

[6] These percentages are based on the following estimated levels of total defense spending (billions of rubles in current prices):
1965: 26 to 37 (i.e., 40×1.09^{5} to 50×1.06^{5}
1970: 40 to 50
1980: 72 to 118 (i.e., 40×1.06^{10} to 50×1.09^{10}

[7] Doe (1982, pp. 31-32) makes this point and quotes Soviet sources that indicate a high rate of inflation in military procurement prices.

try n.e.c. and capital repair, perhaps 5 to 10 billion rubles. Both Cohn (1976) and Leggett and Rabin (1978) have argued that through 1970 the published Soviet figures for defense may be a reasonable measure of most, although perhaps not all, operating expenditures in the defense sector. (Some analysts, such as Lee (1977, p. 278), feel that the official budget may cover construction as well as current expenditures.) Using the defense budget figure, an estimate of 17.9 billion rubles is used for this category. For military construction the CIA (1978, p. 12) estimate is 1 to 2 billion rubles in 1970; and for military research and development 7.5 billion (CIA, 1978a, p. 11). In total this gives:

Military durables:	
(a) Residual estimated	6.8
(b) Included in published investment	2.5–4.5
(c) Industry n.e.c. and capital repair	5.0–10.0
Operations and maintenance	17.9
Military construction	1.0–2.0
Military research and development	7.5
Total	40.7–48.7

This corresponds well with the CIA's estimate of 40–50 billion rublies for Soviet defense spending in 1970. (CIA 1978a, p. 8)

V. SENSITIVITY ANALYSIS OF THE RESIDUAL ESTIMATES

As mentioned above, it is not possible to provide a good measure of the possible range of error in the residual estimates. Each component of the balance is subject to considerable error, and the errors can accumulate in the residual. However, some indication of the sensitivity of the estimates to key assumptions can be provided.

Greater confidence can be placed in the estimates for 1966 and 1972 than those for other years because detailed input-output information is available for these years. Assuming that the input-output accounts reconstructed by Treml et al. are fairly accurate, the main potential source of error in these benchmark years is the estimate of producer durables. Depending on the adjustments used to deflate the investment data for differences in pricing and coverage, and the assumptions made as to the proper lag between the time machinery is produced and the time it is recorded as investment, the estimates of producer durables can vary somewhat. However, the degree of error is likely to be small and, therefore, we can have a fair degree of confidence in the estimates for these two years, and thus in the rate of growth of the residual between them.

For other years the potential for error increases as it becomes necessary to make assumptions as to how the annual data available from published sources should be adjusted to correspond with the accounting methods used in the input-output tables. Since the adjustments involve not only price changes but corrections for differences in statistical reporting and methodology used in the various accounting systems, there is almost no information which can serve as a guide to making these adjustments in years for which the input-output data are not available. The best that can be done is to interpolate between, and extrapolate beyond, the conversion coefficients derived from the 1966 and 1972 benchmark estimates.

The technique employed to extrapolate the conversion coefficients used in the balance calculations (ie, the entries in columns (4), (7), (11) and (16) in Table 1), which involves the use of a logistic function to predict changes in the coefficients, is described, along with the reasons for our choice of the logistic function, in Appendix B. Many alternative approaches are possible. For example, a linear or step function could have been chosen for the extrapolations. With the former, the changes in coefficient would be equally proportioned between and beyond the benchmark years. With the latter, the benchmark value for 1966 would be applied over one range (say up to 1967) and the 1972 value applied thereafter. To show the impact of just such alternatives, the balances were recalculated in the following variations, starting from the 1972 benchmark estimate and extrapolating to 1980:

Variation A: All four sets of coefficients were estimated using a linear extrapolation function from the same 1966 and 1972 benchmark estimates as were used above.

Variation B: The same as Variation A but using step functions rather than linear functions.

Variation C: Either a linear and step function was used to project a particular coefficient series—and the choice in each case was made so as to maximize the growth of the residual in the post-1972 period.

Variation D: The same as Variation C, but designed to minimize the growth of the residual in the post-1972 period.

The resulting 1980 values of the residual, and its average annual rates of growth between 1972 and 1980, for each alternative are:

	1980 value	1972–80 average annual growth rate (Percent)
Baseline estimate	27.51	15.0
Variation A	17.25	8.5
Variation B	34.00	18.0
Variation C	38.83	20.0
Variation D	12.41	4.1

This sensitivity analysis clearly shows that when estimates a few years removed from a firm benchmark are made, the possible range of error is quite large. The 1980 estimates given above range from over 40 percent above to 55 percent below the estimate of 27.51 billion rubles presented in Table 1. In order to obtain reasonably reliable estimates for the late 1970s, data from the 1977 Soviet input-output tables will be necessary. Unfortunately almost no information from the 1977 account has yet been released by the Soviets.[8]

VI. PROJECTIONS OF THE MACHINERY BALANCE TO 1985

As a final exercise the relationships presented above were used to make projections of the machinery balance for 1985 using information from the 11th Five Year Plan and more recent statements concerning revisions in this plan. The key indicators from the plan used in the calculations are the planned rate of growth of output of the machine building industry and the rate of growth of investment. Little information is available on the plans for other components of machinery supply or use, so that projections for these have been made on the basis of past trends.

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[8] In the absence of Soviet data upon which such calculations can be made, there is a tendency in the U.S. to use a worst-case approach, and develop high estimates of Soviet defense expenditures.

The plan guidelines (Basic Guidelines, 1980) called for a 40 percent increase in the output of the machine building sector by 1985 and a 12–15 percent increase in total investment. In a speech on November 16, 1981 Brezhnev indicated that a reduction of 30 billion rubles had been made in the allocation for capital investment. (Brezhnev, 1981) This would mean that investment growth would be limited to only 10 percent over the five year period. Since Brezhnev did not discuss the plans for the machine building sector, we do not know if its plan targets have been revised or not.

Using these figures as guides, machine building GVO (in constant prices) was projected to grow by 30 percent–40 percent by 1985 and producer durables (also in constant prices) by 10 percent–12 percent. The range for the producer durables figure was set higher than 10 percent to reflect the facts that (1) actual investment has often exceeded plan targets and (2) the machinery component of investment is growing more rapidly than total investment.

The rate of growth of retail sales of consumer durables was set at the range of 5 percent to 6 percent per year, reflecting a slow-down from the rate of the previous five years (which was 7 percent). This is consistent with the planned slower rate of growth of total consumption and retail sales in 1981–1985. A 1985 balance of machinery trade in the range of −3 to −6 billion rubles (in current domestic prices) was assumed. The balance has flucuated within the range of −3 to −4 billion rubles during the last few years, but with the additional importation of equipment for gas pipeline construction, the volume of net imports will probably increase. (However, since arms sales are growing in importance as an earner of hard-currency for the Soviets, it is possible that the volume of net imports may decline rather than increase over the next few years.)

All conversion factors and relationships used in the balance calculations above were projected to 1985 in the same manner they were projected from 1972 to 1980. In this way two estimates for military durables for 1985 were obtained, which are shown in Table 1. The lower figure was obtained by combining the lower range machinery supply projections with the upper range of estimates for identified machinery use. The higher figure is based on a reversal of these ranges.

The calculations indicate that by 1985 the residual estimate of military durables may be in the range of 38 to 52 billion rubles in current prices. On an average annual growth basis this is 7 percent to 14 percent, which appears in keeping with the 1965 to 1980 estimated growth of 12 percent on average per year. The upper part of the range is perhaps a better indication of Soviet intentions since it is based on the rates of growth of machinery production and investment contained in the 11th Five Year Plan. The lower part of the range may be a better "forecast", since it reflects past relationships between plan and performance and the current realities of lower productivity and production bottlenecks facing the Soviet economy today.

In these projections, the share of Soviet machinery production used for military durables would increase from 16 percent in 1980 to the range of 17 percent to 22 percent by 1985. The projected share of machinery used for consumption remains at 6 percent to 7 percent, while the share used for investment drops from 32.5 percent in 1980 to the range of 27.5 percent to 30.0 percent in 1985. It is unlikely that machinery supply (production and net imports) could grow much faster than projected, so if military durables use is higher in 1985 it will squeeze consumption and investment even more.

These projections are of course very crude. On top of all of the possible errors in the balance calculations described above, one must add the uncertainties arising from the paucity of information available for the 11th Five Year Plan. Even so, the projections do provide some support for the view generally held in the West that the Soviet Union plans to maintain the rate of growth of defense procurement, even though with slower growth of the machine building sector this means less machinery will be available for nondefense end-uses.

VII. Conclusion

The residual element in the Soviet machinery balance is an unexplained quantity that we have assumed in our use of the Wharton Soviet Econometric Model (SOVMOD) to represent some portion of Soviet military durables use. In addition to the questionability of this interpretation, there are serious difficulties in the calculation of the residual—especially for years in which input-output account data are unavailable—which means that there is a high degree of uncertainty as to its level or rate of growth over time. Even so, Western analysts of the Soviet economy have little recourse but to examine the residual if they wish to explore the relationships between military and non-military uses of machinery.

The calculations presented here represent an attempt to refine and update earlier estimates of the machinery balance. The incorporation of information from the recently completed producer price reconstructions of the 1966 and 1972 Soviet input-output accounts should have significantly improved the quality of the estimates. Even so, without any input-output based benchmark estimates for the late 1970s, the margin of error for the residual estimates obtained for the post-1975 period is in the range of 50% or more.

Based on the estimates and interpretations presented here, it appears that the amount of machinery used by the Soviet military for tactical and strategic weapons has grown since 1965 at an average annual rate of 12 percent per year in current prices. The sketchy information available from the 11th Five Year Plan indicates that a similar rate of growth is planned for the period up to 1985. With the growth rate of machinery output declining over time, the steady growth of military uses has meant that other end-uses, particularly producers durables, have been—and likely will be—allocated shrinking portions of Soviet machinery output.

APPENDIX A: INPUT-OUTPUT CONTROL TOTALS FOR 1966 AND 1972

The following figures on the machine building sector, taken from the reconstructed 1966 and 1972 Soviet input-output accounts prepared by the Foreign Demographic Analysis Division, U.S. Department of Commerce, were used in the calculations described in the paper. (The coverage of the machine building sector as used here is sectors 14–43 in the 110 sector classification order.)

MACHINE BUILDING (SECTORS 15–36 IN INPUT-OUTPUT TABLES)

[Thousand rubles in current prices]

	Producers' prices	Purchasers' prices
Gross value of output:		
1966	47,891.9	52,612.2
1972	84,200.4	93,170.1
Total final demand:		
1966	27,566.5	31.240.6
1972	45,997.1	52,090.6
Consumption (public and private):		
1966	3,781.4	6,324.0
1972	6,351.6	11,290.0
Final demand minus consumption:		
1966	23,785.1	24,916.6
1972	39,645.6	40,799.5
Imports:		
1966	(1,542.0)	1,711.8
1972	4,424.0	4,911.3
Exports:		
1966	(1,011.8)	1,074.3
1972	3,734.9	3,965.6

Sources:

1966 values: Treml, et al., 1977. The producers' prices trade figures were estimated by reducing the purchasers' prices trade data (to account for transport, distribution and tax margins) using the ratios between the 1972 input-output exports and imports in both prices.

1972 values: Gallik, et al., 1982 and Treml and Kostinsky, 1982.

The values for imports and exports in producers' prices were provided by Vladimir Treml in an unpublished memo dated March 1982. Treml considers them to be rough preliminary estimates.

APPENDIX B: DESCRIPTION OF THE EXTRAPOLATION FUNCTION

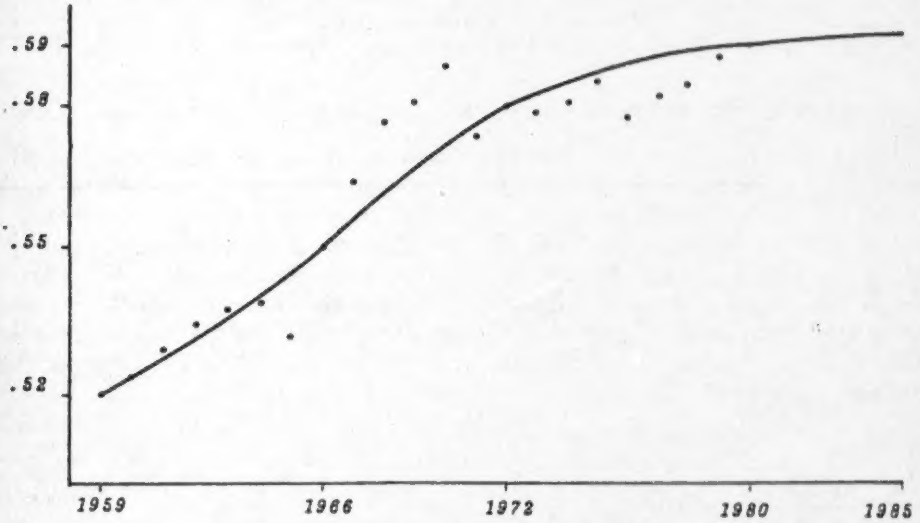
Detailed input-output accounts are available for only two years of the period covered by this study. This presents a problem since input-output data are the basis for the estimates of a number of key ratios and adjustment factors used to calculate balance entries. It is necessary therefore to interpolate between, and extrapolate beyond, the benchmark years 1966 and 1972. This could be done by finding other information which could serve as a guide for fitting a particular extrapolation function, or by arbitrarily choosing to use some straight-line, non-linear or step-wise function.

For one very important ratio—the share of machinery output going to other sectors as an intermediate product—there does appear to be a useful guide for moving the input-output based ratios beyond the benchmark years. As the Soviet economy matures, it can be expected that the growth of exchange of parts, semifabricates and other components of machinery would exceed the rate of growth of total output and thus this ratio would rise over time. The input-output data for 1966 and 1972 indicate that this has in fact occurred, with the ratio rising from 0.42 to 0.45. The key question is how this ratio changed after 1972.

Each year there is published in Narodnoe Khoziasistvo SSSR a table showing the cost-breakdown of inputs into each of the major industrial sectors. The ratios of "basic materials" costs in total costs for the machine building sector are given below:

1965	0.530	1973	0.575
1966	.548	1974	.577
1967	.561	1975	.581
1968	.573	1976	.574
1969	.577	1977	.578
1970	.584	1978	.580
1971	.570	1979	.586
1972	.576	1980	.588

Since two-thirds of total interindustry deliveries of machinery go to the machinery sectors, this provides an indirect indication of the rate at which interindustry uses of machinery output have grown over time. When these ratios are plotted, as shown below, they display a non-linear trend, which approximates a logistic curve. This particular functional form has been shown to be typical of input-output parameter changes in general. (See Almon, et al. 1974.) The key characteristic of the logistic curve is that projected values approach, but do not exceed, a floor or ceiling—an asymptote. This is also a requirement for projected values for the ratio of intermediate demand to output. For both empirical and theoretical reasons, therefore, the logistic curve fitted to the cost data above is used to interpolate and extrapolate values for this key ratio.



For other ratios (see the notes on columns in Table 1) the same logistic curve was fitted to the 1966 and 1972 benchmark values to obtain estimates for other years. In these cases there was no empirical support for this procedure. However, it was desirable, given the lack of better information, to be least be consistent in the functional form chosen for the extrapolations.

Appendix C: Derivation of the Consumer Durables Retail Trade Time Series

In order to develop a time series for consumer durables, the retail sales data in the table below were used. This series covers approximately 85 percent of the value of all consumer durables.

[Units: Millions of rubles in current retail sales prices]

	Watches	Radio equipment	Electric appliances	Bicycles and motorcycles	Autos	Sewing machines
1965	433	1,525	981	716	241	124
1966	455	1,747	1,194	784	(281)	110
1967	480	1,904	1,426	855	(328)	101
1968	512	2,255	1,657	903	(382)	103
1969	537	2,477	1,859	94	(446)	98
1970	578	2,832	2,050	1,009	520	104
1971	611	3,007	2,119	1,054	(1,004)	108
1972	653	3,265	2,263	1,124	(2,351)	115
1973	710	3,139	2,469	1,162	(3,528)	117
1974	797	3,281	2,566	1,248	(4,819)	115
1975	896	3,522	2,733	1,326	5,701	116
1976	951	3,686	2,817	1,384	(6,300)	136
1977	1,060	3,951	2,973	1,504	(7,127)	145
1978	1,165	4,175	3,056	1,634	(7,954)	150
1979	1,296	4,348	3,158	1,748	7,747	154
1980	1,339	4,745	3,264	1,808	8,834	164

Source: Narodnoe khoziaistvo SSSR, various years. (The figures in parentheses were interpolated using data on automobile production.)

Appendix D: Derivation of Price Index for Producer Durables

Basically the same assumptions were made as in the Cohn (1978) paper, i.e., that price indexes for the machine building sector derived by Treml could be used as a deflator for producer durables. Since Treml revised his index, his latest estimates were used. These are presented in Treml (1978). For the period 1959–1970 these correspond to the indexes prepared by Becker (1974). Based on descriptive evidence in the Soviet literature, Treml assumed the following increases in price level for the period 1970–1975 (percent change over previous year).

1971	0.97
1972	1.01
1973	0.95
1974	1.01
1975	1.00

These changes represent a continuation of the approximately 1 percent annual inflation in prices indicated by Becker for the 1968–70 period, except for those years in which there was a declared general price cut (in 1971 and 1973) or when other evidence indicated some overall decline in machinery prices (as in the case of 1975). (See p. 35 and 36 of the Treml paper.)

To extend the series beyond 1975, Treml in private conversation recommended using a 1.5 percent annual rate of price increase. (Treml considers this as only an approximate preliminary estimate.) This slightly higher rate reflects his evaluation of the impact on machinery prices caused by the introduction of special prices for products receiving the new seal of quality (znak kachestva).

It should be mentioned that the above price deflator is applied to the producer durables series on the assumption that the rate of inflation in producer durables is the same as in total machinery output and that the constant price series for producer durables is fairly close to a true constant price basis. For evidence supporting the latter assumption see Cohn (1981) and Cohn's paper in this volume.

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THE SOVIET POLICY FAVORING ARMS OVER INVESTMENT SINCE 1975

By Myron Rush *

CONTENTS

Page
1. The first decision to reduce investment growth 319
2. Why reduce investment growth? 322
3. Did interest groups determine the decision? 324
4. A new, contested principle: investment to grow less rapidly than the economy 325
5. A second and a third cut in investment growth 327
6. Why arms over investment? 328

On three occasions since 1975 the USSR has made large cuts in the growth rate of investment in the economy. These highly consequential decisions reflect Soviet determination to maintain rapid growth of defense spending despite the slowed growth of the economy. This article calls attention to these costly investment decisions; details the circuitous manner in which they were first intimated to the Soviet public (the process whereby they were made of course remains secret); suggests sources of political opposition encountered by these decisions; and explores some of their implications for our understanding of Soviet politics and of Soviet foreign policy.**

1. The First Decision To Reduce Investment Growth

The initial decision to cut sharply the growth rate of investment, taken in 1975 when the "Main Directions" of the tenth five year plan were being worked out, was one of the most striking developments in Soviet politics of the Brezhnev era.[1] It departed from the long-standing practice of allocating an increasing proportion of national income to investment in order to assure rapid and continuing growth of the economy. Priority for investment has been sanctified by an ideological formula that calls for "preferential growth of heavy industry," especially production of investment goods. Equally important, the decision departed from the bureaucratic practice of incrementalism, and in particular went counter to the penchant of Gosplan (the State Committee on Planning) for straightline extrapolation of production targets and key plan indicators. The continued slowing of the economy required major adjustment in the allocation of resources, but a typical bureaucratic solution to this problem would have allocated the projected increase in national income to consumption, defense, and investment at roughly the same proportions as previously. That this was not done, that the main brunt of reduced allocations for 1976–1980 was borne by the investment sector, poses a political, as well as economic, problem that warrants more analysis than it has yet received.

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[1] Growth of investment in the tenth five-year plan was reduced to 24–26 percent, compared to 41 per cent in the previous five-year plan period (1971–1975).

The Politburo had long recognized a need to make the main factors of production—labor and capital—more efficient, but had particularly stressed this since the early 1970s. Improved effectiveness was held to be necessary because of the maturation of the Soviet economy and the reduced growth rate of the labor force owing to demographic causes. Economic propaganda deplored the rising capital-output ratio and stressed the need to make capital more productive. The savings resulting from a planned increase in the effectiveness of production could be used for either of two purposes: to increase output and consequently the growth rate of national income, which had been slowing, unevenly but persistently, since the late 1950s; or to reduce the growth rate of investment, enabling investment funds to be diverted to other purposes—civilian consumption or defense. Of course, the savings could be employed in some combination for both purposes.

The idea that the planned increase in effectiveness might be used chiefly to reduce the share of national income allocated to investment while maintaining the current growth rate of the national economy had been voiced by a few economists in the early 1970s. Finally, in December 1974, Brezhnev revealed in a key address to the Central Committee on the state of the economy that this was also his own view as to how savings to be obtained from increased effectiveness of production ought to be utilized. "The greater the effectiveness [of production] the better will we be able to combine high growth rates of the national economy with an increase in the share of the national income allocated to satisfaction of social requirements." [2] Since national income, in Soviet usage, has two parts, accumulation, chiefly investment, and consumption (here referred to as "social requirements"), increasing the share allocated to consumption suggested a reduced share for investment.[3] Brezhnev's statement was tentative and conditional and, as most speeches to the Central Committee in the Brezhnev period, the speech was not published when delivered. Presumably a decision on the allocation of national income had yet to be made.

Brezhnev's speech was included in a published edition of his economic speeches shorthly afterward, however, and a review of this book by V. N. Kirichenko in the official government newspaper implied that a decision had indeed been made along the lines Brezhnev had intimated.[4] Based on a postulated increase in the effectiveness of production in the tenth five-year plan, Kirichenko indicated that there was to be a reduction both in the growth rate of investment and in the share of national income allocated to investment. In fact, Kirichenko, employing the technical language of the Soviet economist, downgraded investment as a means of increasing production.

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[2] Ob osnovykh voprosakh ekonomicheskoy politiki KPSS po sovremennom etape (On Basic Questions of the Economic Policy of the CPSU in the Present Stage), II, 447. The book went to press on July 9, 1975.

[3] "Social requirements," or consumption in Soviet national income accounts, includes not only consumption by civilians, but also consumption in the military sector as well as capital depreciation. Accumulation includes, along with net investment, changes in inventories and State reserves, so military procurement presumably belongs here.

[4] Izvestia, Aug. 21, 1975. The author was then a high official of Gosplan's Scientific Research Economic Institute; shortly afterwards he was appointed the Institute's Acting Director, and in February 1977 its Director.

> Today the chief source of an increase in production is not so much a further increase in the amounts of capital investments . . . as it is the ever fuller utilization of accumulated production capacities . . .
>
> The decisive area of technical and economic policy is the intensification of production and a long-range changeover to a qualitatively new type of production, which is characterized by a relative saving . . . of embodied labor (reductions in the rate of assets consumption and materials intensiveness of production) and by a substantial increase not only in the amount but also in the share of the resources used by society to achieve an upswing in the people's well-being and accomplish a wide range of social tasks.[5]
>
> The theses on the intensification of production and the qualitative factors of economic growth that are formulated in L. I. Brezhnev's speeches and reports are of very great importance in the formation of the plans for the development of the national economy in 1976–1980 and for the long-range future.

That an increased share of national income was to be allocated to consumption, hence a reduced share to investment, was asserted almost simultaneously in the party journal by Kirichenko's superior.[6] In this way an authoritative decision to reduce the share of national income allocated to investment was deliberately revealed to the interested Soviet public in August 1975 by top officials of the Gosplan Institute, where economic research in support of this decision may have been centered.

A global decision on the allocation of national income was needed at about this time so that Gosplan could make the detailed allocation of the available investment funds to ministries, associations, and enterprises according to the production targets assigned them. Indeed, when the draft "Guidelines of the National Economy" (precursor of the five-year plan) was published several months later, the growth rate of investment had been reduced well over one-third, from 41 percent in the previous five-year plan period (1971–75) to 24–26 percent in the tenth. Subsequently, when Aleksei Kosygin, the head of Government, presented the five-year plan to the twenty-fifth party congress, he emphasized that it provided for an increased share of national income allocated to consumption, consequently a reduced share for investment.[7]

What are the implications of this decision for civilian consumption, for investment in the civilian economy, and for defense? While consumption was to rise as a share of "utilized national income" the planned growth rate of civilian consumption declined. Moreover, consumer goods industry ("Group B") was accorded a lower priority than in the previous five year plan. What of defense? Since defense expenditures include both consumption and investment, a change in their proportions in the national economy does not reveal how total defense spending was to be affected by the cut in the growth rate of investment. Subsequently, basing itself on detailed analysis of the cost of Soviet weapons procurement and the level of construction for defense industry and for the army, CIA concluded that annual defense spending (in rubles) continued to grow in the tenth five-year plan at about the same rate as before.[8]

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[5] The "people's well-being" refers to civilian consumption, while included in "the wide range of social tasks" are various defense needs.

[6] Kommunist, No. 11, August, 1975. The substance of this article by Yefimov, it should be noted, was not put in question by Kommunist's editors by adding the frequently employed notation that a particular article is being published for "purposes of discussion."

[7] Actually, the targeted increase in national income (24–28 percent) was in the same range as that of investment (26–28 percent).

While the reduction in extensive growth (that is growth by increasing the quantity of the factors of production) was largely a natural phenomenon in the case of the labor force, hence unavoidable, this was not equally true of capital. The reduced growth rate of capital resulted from deliberate choice. The leadership had the option to maintain, or even to speed up, the growth of capital while trying to increase its effectiveness, thereby enhancing the growth of national income; however, this was not the path chosen. Instead, the Politburo decided to slow the growth of investment, relying on the planned increase in productivity of capital to compensate for the reduced availability of capital.

2. Why Reduce Investment Growth?

The Politburo's decision in 1975 to reduce the growth rate of investment cannot be explained as due to a reduced need for capital. The productivity of Soviet investment capital had been low and had suffered from a secular decline so that, uniquely among large advanced industrial states, investment historically had grown more rapidly than national income and required an increasing share of national income. Long-standing efforts to improve the efficiency of capital had had limited success. Surveying the Soviet economy toward the end of the tenth five-year plan period, CIA's Office of Economic Research saw a continuing need for large infusions of capital:

> The slowdown in capital formation could not be occurring at a worse time. Greater investment is needed to counter the declining increments to labor, to modernize obsolete plant and equipment, and to stave off the impending energy crunch. The required investment programs are becoming much more costly, however, and their payoff further away as more investment resources must be devoted to Siberia.[9]

Why then did the Politburo decide to cut the growth rate of investment for the five-year period (1976–80) by over a third at a time when the need for capital remained large? No doubt, the decision had both political and economic dimensions. Politically, the decision to cut the growth rate of investment sharply may perhaps best be understood as the necessary consequence of prior decisions not to cut sharply the growth of defense or consumption. The decision not to slow the growth of consumption sharply may have been due to concern that frustrating the consumer's high expectations would adversely affect labor productivity, as well, perhaps, as the political mood of the people. Why, however, was the Politburo unwilling to slow the growth of military spending at a time when circumstances were highly conducive to such a decision? The 1975 decision to sacrifice growth for defense came after the onset of detente, after SALT I and the Vladivostok agreement had recognized Soviet strategic parity with the United States, after the U.S. had suffered defeat in Vietnam, after substantial Soviet theater buildups in Europe and the Far East had improved the military balance, after a decade of rapid increases in Soviet defense expenditures and several years of declining United States spending, in real terms, for defense. The decision was roughly coincident with the Helsinki agreement that virtually ratified Soviet World War Two gains in Eastern Europe. Then, if ever, was a time when economic constraints might safely have been given their due weight against the claims of defense. Yet an opposite choice was made, to maintain the growth rate of defense spending while sharply cutting the growth rate of investment. In effect, investment funds were diverted to defense.

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[8] "The Soviet Economy in 1978–79 and Prospects for 1980," National Foreign Assessment Center, CIA, ER 80-10328, p. 16.

[9] "Capital costs have been rising rapidly, particularly in the extractive industries, as a result of the declining quality and quantity of easily accessible raw materials and, in turn, from the increased reliance on more sophisticated and expensive recovery techniques. The need to transport these commodities over much greater distances . . . also has pushed up capital expenditures. Major gains in energy efficiency may require upgrading industrial technology—a very time-consuming, capital-intensive process. . . ." Ibid., p. 12.

The decision to put the main burden of the slowed growth of the economy on investment also had an economic dimension. A large share of Soviet national income—around thirty percent—is allocated to investment. Soviet economists have occasionally argued that excessive growth of the capital-labor ratio contributed to the reduced effectiveness of capital; it followed that a reduction in the growth of investment might be a positive good, enabling improvements to be made in the utilization of capital. Whatever the merits of this argument, it was not widely debated in economic journals and apparently did not command wide professional support. Assuredly, it is not the kind of argument that would ordinarily appeal to Soviet political leaders, who for over a decade had fought the declining growth rate of national income by regularly increasing the share allocated to investment.[10] No political leader, to my knowledge, has subscribed to the view that reducing the availability of capital would contribute to its more efficient use. On the contrary, Brezhnev strongly lamented the shortage of capital in the tenth five-year plan. After telling the Central Committee that the new plan allocated the huge sum of 170 billion rubles to agriculture, Brezhnev said, "I tell you frankly, it was not easy to find it. We had to curtail (urezat') the requirements of other branches of the economy."[11] Viewing matters in this way, Brezhnev seems unlikely to have expected the reduced growth of investment to be good for the economy. Certainly, there were good grounds for concern that insufficient capital in the tenth five-year plan would hamper capital intensive projects in energy, raw materials extraction, transportation, agriculture, and regional development, particularly in Siberia, required to sustain economic growth.[12] The decision to decelerate investment has not been justified as contributing to improved efficiency in the economy, but two other reasons have been suggested: the decision has been justified implicitly, as a necessary accompaniment to the reduced growth rate of the economy; it has been justified explicitly as making possible increased satisfaction of the people's needs.

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[10] Previously, however, in a somewhat analogous situation in the early 1960s when the growth of the labor force was also slowing, a much higher growth rate of investment, around 13 percent, was also cut sharply.

[11] Speech to the Central Committee, 25 October 1976.

[12] The tenth five-year plan also allocated sharply increased and substantial investment funds to ecological programs.

The decision on apportioning the projected growth of national income to the various claimants is political and would not be allowed to go by default to technocrats. Brezhnev has several times emphasized the Politburo's increasing involvement in the drafting of the plan. The deliberations that led to the decision to cut investment growth appear to have been conducted within a rather narrow circle of Politburo leaders, aided by a small number of government and Central Committee officials, based on calculations provided by economic consultants and planning officials. A formal decision on the plan's global indicators probably was adopted by the Politburo in mid-1975, presumably at the instigation of Brezhnev, who had earlier broached it in public. Subsequently, after the decision had been conveyed to the public circuitously by economists connected with Gosplan, the Supreme Soviet enacted a reduced rate of growth for investment in the tenth five-year plan. Thus does the Politburo decide for the Soviet people and the Soviet people learn what the Politburo has decided.

3. Did Interest Groups Determine the Decision?

The management apparatus that was so powerfully affected by the decision does not appear to have been deeply engaged in the discussions that led to it. Certainly economic administrators did not have a decisive voice in the outcome. This puts in question the conventional wisdom that there is a dominant interest group centered in heavy industry which observers frequently conjoin with interest groups in defense industry and the army and refer to as the "military-industrial complex." While the political potency of the army and of defense industry is evident, there are serious grounds for doubt that officials responsible for heavy industrial production in the civilian economy constitute an interest group of comparable weight. According to Brezhnev and other top leaders, the leaders of industry (including heavy industry) have powerful appetites for investment capital. They may be supposed to have resisted the decision to reduce the growth rate of total investment, for they were not compensated by receiving an increased share of that investment. In fact, they were given no more favorable treatment than agriculture, which is generally thought to be represented in Soviet politics by a weak interest group.[13]

Within heavy industry itself there was a wide disparity in the treatment accorded the various branches. Those less favored, like ferrous metallurgy and transportation, suffered badly in the plan's initial years from inadequate capital investment, which increasingly was diverted to the energy sector. Subsequently, as production shortages created bottlenecks in ferrous metallurgy and transportation, the limited supplies of capital had to be increased somewhat and redirected into such sectors as these from others less-favored still.[14] Thus, apart from top priority sectors like energy, officials in most branches of heavy industry had grounds to complain about the short supply of capital. Indeed, some did complain, including officials concerned about slow progress in the crucial sector of machine building. (See footnote number eighteen and the corresponding quotation in the text.)

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[13] Agriculture's favorable treatment in the tenth five-year plan may be due to Brezhnev's personal commitment to current programs, and might be jeopardized when Brezhnev leaves the scene.

Even if it were supposed that officials responsible for civilian heavy industry are not as avaricious for capital goods as Brezhnev has alleged, they nonetheless had strong grounds for dissatisfaction with the plan, inasmuch as the growth rate of their production targets was reduced considerably less than the growth rate of investment capital allotted them. In the course of the ninth five-year plan (1971–75) national income rose 28 percent, assisted by a 41 percent increase in total new investment; in the course of the tenth five-year plan national income was targeted to rise a comparable amount, 24–28 percent, assisted by only a 24–26 percent rise in total new investment. While the entire civilian economy was being pressured to increase production without benefit of the full complement of capital investment that had been provided in the past, civilian heavy industry was particularly disadvantaged since it was deprived of the preferential treatment previously accorded it.

Economic managers in heavy industry were required by the tenth five-year plan to produce more with less—something Soviet economic administrators, as a breed, are known to resist. That they subsequently failed, as a group, to meet this requirement reinforces the argument that they probably resisted the demand when first confronted with it. It is difficult to avoid the conclusion that the ministries and enterprises engaged in civilian heavy industrial production are not as powerful an interest group as many Sovietologists have supposed. True, they often succeed in circumventing the controls of Gosplan and the Council of Ministers, but their influence on Politburo deliberations in recent years has been modest indeed.

4. A NEW, CONTESTED PRINCIPLE: INVESTMENT TO GROW LESS RAPIDLY THAN THE ECONOMY

If, when they adopted the tenth five-year plan, the Soviet leadership calculated that improved efficiency in the utilization of industrial plant and resources would largely compensate for the slowdown in capital formation, by 1979 they knew better, for they had failed to achieve a number of key plan targets, including growth of productivity. Despite these failures, they signalled their intention to continue cutting investment growth. In fact reducing investment's share of national income was elevated to a principle of planning. This new principle was proposed by Aleksei Kosygin, then head of Government, in a key 1979 article. After calling attention to the long-standing practice of increasing investment more rapidly than national income, Kosygin asserted that this had been reversed in the first three years of the current plan.[15] He called this "a

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[14] Investment, which was planned to increase 24–26 percent, actually increased 29 percent in the five-year plan.

[15] In the two years after Kosygin made this claim, however, the growth of national income fell sharply; the final result in the tenth five-year plan was a 29 percent increase in investment

Continued

positive tendency" that "must be incorporated in plans for the future." If Kosygin's injunction were followed, and if the growth rate of national income declined in accordance with the plan, the result, of course, would be a further deceleration of investment growth. That future economic plans allocate a reduced share of national income to investment was also advocated by several economists, and presumably reflected decisions that had already been adopted.[16]

The principle that the share of national income allocated to investment must decline was elaborated and justified in a key polemical article by a top Soviet ideologue, Vadim A. Medvedev, head of the Central Committee's Academy of Social Sciences.[17] According to Medvedev, not until the USSR had achieved "mature socialism" could the development of production be directly subordinated to satisfaction of the needs of the working people. Until then, insuring the full prosperity of all members of society had had to be subordinated to the resolution of more urgent historical problems, such as "overcoming the long-standing economic backwardness of the country, strengthening its defense capability, technical reequipments, restoration of the economy destroyed by the war, and so on." Satisfaction of the needs of the working people was "moved into first place" initially in the ninth five-year plan.

The reduced priority assigned to growth met resistance. According to Medvedev:

> Occasionally one encounters arguments evidently cast up by one or another difficulty or unresolved problem, such as: is it not necessary first to complete the industrialization of agriculture and fully eliminate its lagging, develop still further machine building and other heavy industry sectors, and only then undertake the basic solution of problems related to upgrading the people's prosperity?

One author of such arguments whom Medvedev may have had in mind was Politburo member Andrei Kirilenko, who has special responsibility for machine building and has been a persistent advocate of its needs. Not surprisingly, Kirilenko's personal fortunes have sunk in recent years even as the investment policies he favors have fallen into decline. Medvedev answers those who, like Kirilenko, lament the scarcity of capital and seek increased investment not by detailed rebuttal but by a direct appeal to party authority: "The answer to this question is given in party documents." Despite his sharp reply, efforts to increase investment evidently continued, for the following year another top ideologist found it necessary to polemicize against partisans of investment.[18]

Medvedev denies that consumption levels could be repressed indefinitely; "Modern socialist production cannot be developed successfully over a long period of time without subordinating it to the

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and only a 24 percent increase in national income. A. N. Kosygin, "Course Toward Effectiveness: The Most Important Link in the Party's Economic Policy," Planovoye khozyaistvo, No. 7, 1979, pp. 3-17. Kosygin had prevciously stressed the need to reduce the share of accumulation in national income in his speech on the five-year plan to the Twenty-Fifth Congress.

[16] See, for example: Ye. Ivanov and A. Eskina, "The Intensification of the Investment Process," in Planovoye khozyaistvo, No. 5, 1979, pp. 5-9; A. G. Aganbegyan, "New Stage in the Evolution of the System of Economic Management," in Eko, No. 10, October 1979, pp. 6-7; and A. G. Granberg, "Siberia in the National Economic Complex," in Eko, No. 4, April 1980, p. 101.

[17] "Leninist Principles of Administering the Economy in Contemporary Conditions," in Kommunist, No. 5, 1980, pp. 22-25.

[18] "Mature Socialism and the Social Sciences," Kommunist, No. 16, November 1981. The author, P. Fedoseev, like Medvedev, avoids the question of defense allocations.

satisfaction of the needs of the people." This no doubt reflects a recognition that long-term economic growth requires incentives for workers and managers, but it may also reflect concern that low consumption levels could lead to dangerous political discontent.

In defending consumption against the competing requirements of production, Medvedev for some reason finds it necessary to deny that the economy is in crisis.[19] Although he attributes this allegation to bourgeois propaganda, perhaps Soviet partisans of increased investment, as well as partisans of basic organizational reform, have also charged that the economy is headed for a crisis. Whether or not they have done so, Soviet perception of the steady decline in the growth rate of national income is beyond question. According to Soviet statistics, annual growth of national income averaged around seven percent in the eighth five-year plan, five percent in the ninth, and four percent in the tenth. The Soviet leadership is familiar with these key official figures and occasionally quote them.

While the claims of consumption and investment are disputed in the press, allocations to defense are not questioned explicitly, although even here there are occasional hints of controversy.

5. A SECOND AND A THIRD CUT IN INVESTMENT GROWTH

The "basic guidelines" for the new five-year plan adopted in March 1981 by the twenty-sixth party congress revealed Kosygin and Medvedev to have been authoritative commentators on Soviet economic strategy, but well off the mark in anticipating the strategy's success.[20] Contrary to what they had implied, national income in the course of the tenth five-year plan (24 percent) grew less rapidly than total investment (29 percent). Consequently although the growth rate of investment declined, its share of national income actually increased. Nevertheless, undeterred by this manifest failure to achieve more efficient use of economic resources, the Soviet leaders once more sharply cut the planned growth rate of investment—this time by over half: in the tenth five-year plan period it was 29 percent, in the "Basic Guidelines" for the eleventh, only 12 to 15 percent. Consequently, the increment in capital investment projected in the Basic Guidelines was considerably less than the increments in each of the last three five year plans.

The Soviet leaders constructed the eleventh five-year plan as they had the tenth, on the supposition that national income would grow more rapidly than investment—something the USSR has rarely achieved in the past half-century. Although the Basic Guidelines for the eleventh five-year plan targeted investment to grow at only half the previous rate, national income was expected to grow almost as fast as it did in the tenth.[21]

Whatever the Soviet leaders hopes and expectations when they adopted the Basic Guidelines in March 1981, when the Central

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[19] "We decisively reject as groundless and as having nothing in common with reality the fabrications of bourgeois propaganda about some kind of crisis in the socialist economy, and its hypocritical advice on how to 'improve' and 'liberalize' socialism. This conceals the profound wish on the part of our opponents to weaken its foundations."

[20] Pravda, March 5, 1981.

[21] The figures for growth of national income in the plan period are 18 to 20 percent—down from 21 percent—and for total investment 12 to 15 percent—down sharply from 29 percent.

Committee met in November they found the economy's performance disappointing. Consequently, in constructing the five-year plan itself (which is a detailed elaboration of the Basic Guidelines), they found it necessary to make new cuts. As before, they spared defense and consumption while cutting the growth of investment for a third time, by 30 billion rubles in the eleventh five-year plan. Once again, as in 1975 and 1980, Brezhnev did not claim benefits would result from reduced investment growth. Instead, he justified the decision as due to a lack of resources. "Account was taken of the available material and labor resources, the capacity of construction organizations and also the considerable extent of incomplete construction. [The result was] a realistic, better balanced plan of capital construction, creating the necessary conditions for normal work." But was the revised plan really "realistic"? Brezhnev himself seemed dubious. "Together with an increase in the overall volume of capital investment by ten percent, the draft plan envisages 18 percent growth in national income. This will, undoubtedly not be easy to achieve. But the very juxtaposition of the two figures already indicates that at the basis of the plan a course has been set for the better utilization of all resources." In other words the plan assumed that improved capital productivity would compensate for the scarcity of capital, a dubious assumption inasmuch as capital productivity during the previous decade had actually declined.[22] From this it would appear that the Politburo, in once again decelerating investment growth, is reconciled to the prospect that national income per capita may grow slowly in the next several years, if at all.

6. WHY ARMS OVER INVESTMENT?

Why has there been this prolonged and determined military buildup? It is often stated that the high priority given defense stems from an historical preoccupation with the nation's precarious security. But the Soviet leaders have not invariably displayed an acute sense of the USSR's vulnerability. In the decade after Stalin's death, for example, both Malenkov and Khrushchev were remarkably relaxed about the adverse Soviet military position. Although the USSR lagged far behind the United States in military strength, neither Soviet leader felt obliged to force the pace of Soviet weapons deployment and Khrushchev actually cut the size of the Soviet armed forces sharply.

Against this objection, it is argued that Soviet acquiescence in United States military superiority ended when the Cuban missile crisis demonstrated how dangerous this was politically, both to the USSR and to its leaders. Actually, it does not appear that Soviet military spending rose sharply in the aftermath of the 1962 confrontation of the two super-powers. But even assuming that heightened fears of Soviet vulnerability following the Cuban missile crisis fueled the initial increases in defense spending, this hardly explains why the arms buildup has continued for so long at great economic cost, and in the absence, until recently, of a strong U.S. response. In any event, if fear for the vulnerability of the Soviet homeland has motivated Soviet arms spending in the 1970s, why has it not deterred the USSR from projecting its power into highly exposed positions in Africa and the Caribbean Sea, thereby provoking renewed hostility and posing an increased United States threat to the Soviet homeland?

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[22] Report to the Central Committee, Provda, November 17, 1981.

It is conjectured that the dispute with China has compelled the USSR to increase its military forces in order to deal with a new potential enemy. But again, Khrushchev did not believe the worsening Soviet dispute with China—which was already serious in 1960—necessitated a buildup of Soviet military forces in the Far East. Are China's current armed forces, which have been unable to protect major Chinese security interests against Vietnamese attacks, really a threat to the USSR? Until the 1970s the Soviet leaders assigned to growth of the economy at least equal priority with growth of defense spending; they did so if for no other reason than that present economic growth provides the basis for future military spending. By deliberately sacrificing economic growth to a near-term buildup of its military forces—including forces deployed against China—the USSR may be worsening its position a decade hence, when China's military potential may be substantially larger than it is today. Moreover, even while deploying large armed forces on the Chinese border, the Soviet Union has substantially improved the relative strength of its forces in Europe.

It is also said that the long-standing and continuing Soviet buildup is the instinctive expression of a Russian preference for large masses of men and material as a necessary bulwark of security. But how then explain Soviet military conduct in Afghanistan, where limited numbers of men and arms are being employed in the only war the USSR has fought since World War II?

Finally, it is argued that a military-industrial complex has compelled the political leadership to favor rapid military development at the expense of economic growth. Granted, when the political leadership engaged in factional struggle in the middle and late 1960s Brezhnev had reason to curry favor with the military leadership. But why should Brezhnev continue to do so a dozen years later, when he has acquired a large measure of personal power? It has not mattered who was Minister of Defense—whether Marshal Grechko, war hero and professional soldier, or, since 1976, Dmitry Ustinov, party official and economic administrator—the military buildup has increased regardless. It is reasonable to conclude that throughout these years Brezhnev has been personally committed to the steady, prolonged and costly buildup of Soviet military power.

The top priority given to Soviet armed forces during the Brezhnev period, then, cannot rightly be attributed to long-standing feelings of insecurity; neither is it a response to new military dangers, nor a tribute exacted by professional soldiers from Soviet politicians. The arms buildup appears to have resulted from a revaluation by the Brezhnev leadership of the place of military means in the attainment of Soviet objectives. The early results of this reappraisal led Khrushchev in his memoirs to complain of a "new trend of military overspending." In the dozen years since he expressed this criticism, the military buildup has continued unabated.

The high rate of defense spending has been sustained in recent years at the cost of new civilian investment, but this is a wasting asset.[23] An increasing share of the diminishing annual increment in national income is now being allocated to defense; by the mid-1980s defense may receive more than half the increment, leaving very little for additional civilian investment and for the consumer.[24] Stepped up increases in defense expenditures in a new arms race against an American economy that is roughly twice the size of the Soviet economy could only be achieved by making repeated cuts in consumption. Reducing Soviet living standards at a time of tight labor supply, however, could further weaken the economy, creating a downward spiral.

While there are numerous causes for the worsening Soviet economic difficulties, the Politburo's priority development of military power is important among them. The favorable military environment for Soviet foreign policy in the next half dozen years is the consequence of willful decisions carried out with stubborn determination at painful economic cost.

AUTHOR'S NOTE: FEBRUARY 1983

Since I wrote the body of this essay, several Soviet articles have appeared arguing that reduced investment growth entails serious costs in slowed growth of the economy. Gosplan evidently is considering doubling the current very low rate of investment growth (to around 3 percent) in the upcoming twelfth five year plan (1986–90). At this writing the likelihood of such a pronounced change in investment policy and the priorities that would govern the search for the requisite resources among defense and consumer programs are difficult to judge.

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[23] Annual growth of investment, currently two percent, if cut further would end hopes of rapidly modernizing Soviet industry and improving efficiency.

[24] Defense would take more than half the increment of national income if it grew at an annual rate of four percent while growth of national income fell to one percent. In these circumstances, even assuming capital investment did not increase at all, per capita consumption would decline.

THE DYNAMIC BURDEN OF SOVIET DEFENSE SPENDING

By Gregory G. Hildebrandt *

CONTENTS

Page
Overview 331
I. Introduction 332
  Concepts of defense burden 333
  Issues in defense tradeoff 334
  Technological issues 334
  Policy issues 334
  Economic impact issues 335
  Methods of quantitative analysis 335
II. Dynamic defense burden 336
  Tradeoffs with existing capital fully transferable 336
  Case A—only weapons producing resources transferable to new capital formation 336
  Case B—weapons producing resources more productive 340
  Case C—all defense resources transferable to capital formation and are more productive 340
  Effect of bottlenecks on tradeoffs 341
III. Some general observations 342
Annex—Analytical Framework 343
  Macro model 343
  Alternative productivity estimates and choice of production function 344
  Multi-sector model 348

FIGURES

1. USSR: Defense spending—economic performance tradeoffs assuming only weapons resources transferable 338
2. USSR: Impacts of no defense spending growth on economic performance, 1981-90 339
A1. Marginal product of capital 345
A2. USSR: Alternative forecasts of GNP and per capita consumption growth 347
A3. Stylized multi-sector model 349

OVERVIEW

Indicators are currently ambigious as to whether the Soviets are planning to maintain annual defense spending growth at the long-term historical average of 4-5 percent. GNP and other economic indicators are expected to grow more slowly during the decade, however, and maintaining the historical trend will increase the share of GNP consumed by defense from its current value of about 13 percent to more than 14 percent by mid-decade. If the historical growth rate continues until 1990 and economic growth continues to be slow, the defense share will rise to approximately 16 percent. Although it is not known whether the Soviet leadership is

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contemplating a slowdown in defense spending as a response to their economic predicament, they do understand that defense spending imposes a burden on their economy and will be assessing their economic alternatives throughout the decade.

The share of GNP going to defense provides a "snapshot" view of defense's consumption of resources and is called the static burden of defense. The cumulative effect of defense spending on variables such as GNP and per capita consumption is the dynamic burden of defense, and is most conveniently measured in terms of the interrelated changes in the growth rates of these variables.

Our estimate of the dynamic burden of defense shows that by halting growth in defense spending over the remainder of the decade rather than maintaining defense growth at historical trends, the Soviets could increase the annual growth rate of GNP by about one-tenth to one-fifth of a percentage point per year through 1990. Per capita consumption growth, however, would be over one-half of a percentage point higher than if defense spending growth were to continue.

The effect on GNP growth is fairly small. This is because the additional capital obtained when there is no defense spending growth is simply too small relative to the current size of the Soviet capital stock to greatly expand the productive capacity of the Soviet economy. That is, the growth in productive capacity is limited. On the other hand, modest increases in the growth of per capita consumption could be obtained through a reallocation of resources because some of the existing as well as incremental defense capacity could be transferred to the production of consumer goods and services.

There are always significant uncertainties associated with such calculations. In particular:

—The time required to transfer resources from the defense to the civilian sector is uncertain.

—There could be significant differences in the productivity of defense versus civilian resources.

—The impact of defense spending on the bottleneck pressures that pervade the Soviet supply system is difficult to assess.

Our analysis of these uncertainties indicates that the cost to GNP growth of maintaining historical defense spending patterns probably would remain less than one-half a percentage point per year and that cost in terms of per capita consumption growth foregone would be less than one percentage point per year.

I. INTRODUCTION

An important issue is whether the Soviet Union is planning to maintain the historical 4 or 5 percent average annual growth rate of defense spending during the 1980s when overall economic performance is expected to continue to deteriorate. If defense grows faster than the rest of the economy, the share of GNP allocated to the defense sector will increase. If the historical growth rate of defense spending is maintained, and economic growth remains slow, the defense sector, which now consumes about 13 percent of GNP, will receive over 14 percent of GNP by 1985 and 16 percent by 1990.[1]

The Soviet leadership has acknowledged the burden of defense spending. Brezhnev, for example, spoke of the "burden of the arms race," and Chernenko has stated that reducing arsenals would "make possible the transfer of a considerable part of the resources swallowed up by the arms race to creative ends." [2]

It is likely that Soviet decision makers understand that a rising defense share contributes to the deterioration of economic performance in general. If the size of the defense sector is increased at the expense of investment, there would be a decrease in the growth of the capital stock and in the growth of the economy. Alternatively, if the rate of capital formation is maintained when the defense share rises, then there would necessarily be a reduction in the share of GNP which the consumer would receive.

A relatively larger defense sector can have other detrimental effects on economic performance. If the defense establishment continues to absorb a substantial share of new scientists and engineers and receive first priority for resources, it will remain difficult for the Soviets to make their planned shift from extensive to intensive growth with its emphasis on improved productivity. Brezhenev recognized the need to transfer high technology to the civilian sector and charged the Council of Ministers with:

> Determining precisely which defense industry scientific and design collectives could give active assistance to certain types of civilian machine building, give assistance in developing highly efficient and higher quality models of machines and give assistance in formulating specific programs and targets.[3]

This study does not attempt to predict the future path in defense spending to be chosen by the Soviet leadership. Its focus is instead the estimation of the economic implications of alternative choices facing the leadership during the 1980s. Domestic economic problems may create pressures for the Soviet leadership to reduce the growth rate of defense spending. On the other hand, the increase in the growth rate of U.S. defense spending will surely result in opposing pressures. The analysis presented in this paper provides some insight into the aggregate economic tradeoffs implied in weighing these opposing forces.

CONCEPTS OF DEFENSE BURDEN

The share of GNP going to defense provides a "snapshot" view of defense's consumption of resources and is called the static burden of defense. This measure is useful in assessing what is being foregone during a particular year as a result of the flow of resources into the defense sector.

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[1] As discussed in "Soviet and US Defense Activities, 1971–80: A Dollar Cost Comparison," Central Intelligence Agency, SR 81-10005, January 1981, Soviet defense spending is expected to continue to grow at historical rates when measured in dollars. The continuation of the growth decline through 1985 is discussed in "Simulations of Soviet Growth Options to 1985," Central Intelligence Agency, ER 79-10131, March 1979. See, however, footnote 21 on p. 350. Throughout this analysis, all economic variables are measured using constant 1970 rubles.

[2] Brezhnev dinner speech for Mexican President Lopez Portillo in Moscow 17 May, reported in TASS, 17 May 78. Chernenko election speech in Kishenev 26 February, reported in Sovetskaya Moldaviya, 27 February 1979.

[3] Speech of CPSU CC plenary session, 21 October, reported in TASS 21 October 1980.

In contrast to the "cost" of defense in a particular year, the dynamic burden of defense measures the cumulative effect of defense spending over a longer period of time. This burden measure evaluates what is being foregone over a period of several years, and is most conveniently measured using trade-offs in the growth rates of defense, per capita consumption, and GNP. The most interesting trade-off relationship is between the growth of defense and the growth of consumption since each use of goods and services directly competes with the other. However, because the dynamic burden is concerned with the cumulative effect on the economy during a specified time period, it is also appropriate to compute the effect of variations in defense growth on economic capacity. Therefore, the trade-off relationship between the growth rates of defense and GNP provides a further indication of the economic implications of alternative defense spending policies.

ISSUES IN DEFENSE TRADEOFF

There are a number of technological, policy, and economic impact issues that bear on the estimation of the dynamic burden.

TECHNOLOGICAL ISSUES

One technological issue deals with the transferability of resources in the short term and in the long term. An important example of this issue relates to the capital equipment used to produce weapons and investment goods. If there were a change in economic priorities, say a reduction in the growth of weapons, would it be possible for the Soviets to use equipment that was designed to produce weapons in the production of investment goods? Over an extended period of time, one would expect resources to be more transferable since new equipment can be more readily redirected to alternative uses than can equipment that is older and more specialized.

A second technological issue deals with quality differences between defense and civilian resources. Are defense resources more productive than those available to the civilian economy, and if so, would these resources retain their high productivity if they were shifted to the civilian economy? Much has been written about this issue but the impact on economic performance remains very speculative.

POLICY ISSUES

An example of an important policy issue is the choice between production of consumer versus producer durables. If the growth of weapons production were reduced, would the released resources be directed immediately to the consumer, or would they simply be transferred to the production of new investment goods? If they were directed toward investment goods, then the economic capacity of the economy could be expected to increase so that in later periods more consumer goods (or possibly defense goods) would be available.

A related policy issue deals with the long-standing Soviet concern with the allocation of investment to heavy industry versus consumer goods. Would the resources released by a slowdown in defense spending growth be used to continue to develop the Soviet industrial base or would they be applied to the immediate expansion of the agriculture, processed food, or soft goods sectors? This policy issue also bears directly on the issue of current versus deferred consumption.

ECONOMIC IMPACT ISSUES

Consumption, investment, and defense are the primary end uses of goods and services, and a reduction in defense growth would affect the distribution of output produced from existing capacity. These end use or distributional impacts can be distinguished from output or growth impacts which are associated with the non-defense uses of goods and services produced from new capacity made possible by slower defense growth. Any change in priorities between defense and consumption will shift the shares of each in the use of GNP through both shifts in the use of old and new productive capacity.

METHODS OF QUANTITATIVE ANALYSIS

Two methods of quantitative analysis are used in this study to estimate the trade-offs between defense growth and economic performance. These methods incorporate alternative assumptions about the issues noted above.

One method employs a small macro model of the Soviet economy to focus on the case where the use of productive capacity is transferable between the defense and civilian sectors on demand. We look at expansion in economic capacity resulting from a reduction in defense spending growth when only those resources used to produce weapons are transferable on demand to capital formation. We also examine two other cases: The situation in which additional defense resources—primarily those allocated to Research, Development, Test and Evaluation [RDT&E]—are directly transferable to capital formation; and the case in which defense resources are assumed to be more productive than those of the civilian economy.

Although this model provides a reasonable first approximation to the trade-off possibilities, such an approach may permit the transfer of defense capacity too readily, and may also fail to account fully for the disruption in resource flows and the associated impact on the bottleneck pressures when there is a shift in economic priorities. Within any economy, there are specific relationships between the production of gross outputs—the materials, energy and machines, and such—and the fulfillment of the final demands—consumption, investment and defense. These final demands are the end uses of GNP, and when the composition of these end uses changes, one should account for changes in the supporting gross outputs. Therefore, a second approach is also employed to take account of these factors. A small multi-sector model of the Soviet economy is used to estimate the trade-off between the growth rates of per capita consumption and defense spending that reflects both intersectoral bottlenecks and limited transferability of exising capacity.[4]

II. DYNAMIC DEFENSE BURDEN

We have called the cumulative effect of defense spending on economic performance the dynamic burden of defense, and measure it by changes in the growth rates of key economic variables such as GNP and per capita consumption associated with a change in the growth of defense spending.

TRADEOFFS WITH EXISTING CAPITAL FULLY TRANSFERABLE

We considered a number of cases to estimate the effect of a variation in defense growth under the assumption that existing productive capacity can be easily shifted between defense and civilian uses. This condition leads to the greatest gains possible from a given shift in priorities. This included assuming that:

> Only resources used to produce weapons (military machinery) are transferable to new capital formation.
>
> Weapons producing resources are twice as productive per ruble as those used to produce civilian capital.
>
> The remaining defense resources, particularly RDT&E, are also transferable to new capital formation and are twice as productive per ruble.[5]

CASE A—ONLY WEAPONS PRODUCING RESOURCES TRANSFERABLE TO NEW CAPITAL FORMATION

In this case we assume that the defense resources transferable to new capital formation can only be obtained from the machine building sector. These are the resources which support most military procurement and repair. Other defense resources associated with RDT&E and military operations are not assumed to be directly transferable into capital formation. When defense spending growth is reduced, these non-procurement resources are employed in the production of consumer goods and services.[6]

Within the Soviet machine building and metal working sector (MBMW), both civilian and military machinery are produced. Producer durables are the predominant part of civilian machinery and represent the machinery and equipment investment part of capital formation. The military machinery produced in the machine building sector consists primarily of military hardware.

The macro model assumes that the weapons producing resources in the MBMW sector are transferable to capital formation on demand. There is some evidence that this assumption may be a realistic approximation of Soviet reality at least for modest shifts in procurement levels. The defense industries have frequently been exhorted by the Soviet leadership to produce more civilian goods. This suggests that defense plants may often be dual production facilities that are capable of both military and civilian production.[7] To the extent that civilian and military products share a similar production technology, dual production facilities ease the transferability of resources between the defense and the civilian sectors.[8]

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[4] See the Annex for a full description of the two models.

[5] There are other cases that might also be considered. For example, if total factor productivity is assumed to increase by one percentage point when defense spending growth is reduced to zero, the growth rate of GNP will also increase by an additional percentage point over that achieved in any of the three cases. One might then assume that this increase in capacity could be used to produce extra consumer goods. It is difficult though to determine how total factor productivity will be affected by changes in defense spending.

[6] Military personnel expenditures are held constant throughout the decade at the defense spending growth rates considered in the different cases.

It actually might not be necessary to transfer the existing defense capacity unless weapons production were reduced below current levels. When there are only marginal reductions in the growth rate of weapons production, the real question is whether the increment to production capacity that was originally intended for weapons production can be readily transferred to the production of civilian machinery. This capacity increment represents primarily new structures and new machine tools. New structures can be readily directed to alternative uses, and the predominant use of general purpose machine tools in the Soviet Union indicates that these capital goods are easily transferable as well.[9]

Figure 1 shows how the average growth rates of GNP and of per capita consumption over the entire decade would be affected by alternative defense spending assumptions. It is apparent that changes in the growth rate of defense spending in the range examined do not greatly impact the average growth rate of GNP during the decade, but do have a moderate effect on the average growth rate of per capita consumption. For example, if defense spending growth were reduced from a baseline historical trend of 4.5 percent per year to zero, extra GNP growth of about .1 percentage point per year could be obtained. However, growth in per capita consumption would be expected to increase slightly more than one half a percent per year.[10]

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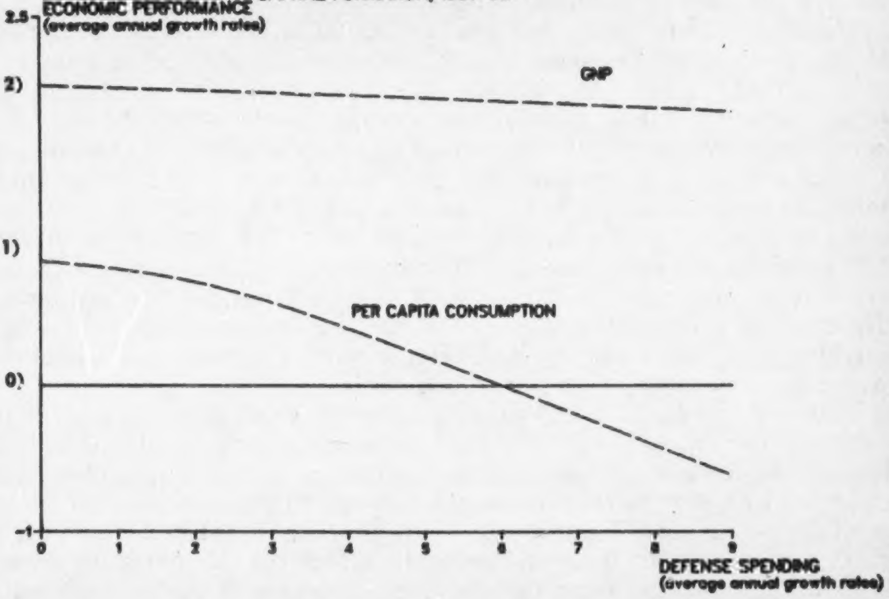
[7] Andrew Sheren discusses this relationship in "Structure and Organization of Defense-Related Industries," *Economic Performance and the Military Burden in the Soviet Union* Joint Economic Committee, September 1970, p. 128. Also, Breshnev indicated in 1971 that 42 percent of the "defense industry" was earmarked for civilian purposes. See L. I. Breshnev, Otchetny Doklad Tsentral'nogo Komiteta KPSS XXIV S'ezdu Kommunisticheskoe Partii Sovetskogo Soyuza, March 30, 1971. Moscow: Politizdat, 1971, p. 82.

[8] The transportation sector has been one of the key bottleneck sectors in th Soviet Union. In 1979 Breshnev discussed the wide ranging problems of the transportation sector and stated that "The situation in transportation must change for the better in the immediate future." (Speech reported at the 27 November 1979 Central Committee CPSU Plenum, reported in Kommunist, No. 17, Nov. 79, pp. 6–18.) Yet, the problems seem to be at least partially an implication of some fairly direct competition between transportation equipment and tanks and armored vehicles which are produced with a similar array of material inputs. Between 1976 and 1980, the production of both tanks and armored vehicles is reported to have increased by about 20 percent at the same time as the production of railcars decreased by over 10 percent. The information on tank and armored vehicle production is contained in the "Statement of Major General Richard X. Larkin, Deputy Director, and Edward M. Collins, Vice Director for Foreign Intelligence, Defense Intelligence Agency, before the Joint Economic Committee, Subcommittee on International Trade, Finance, and Security Economics, on the Allocation of Resources in the Soviet Union and China—1981, 8 July 1981."

[9] Although the Soviet Union is the world's largest producer of machine tools, their level technology for both conventional and numerically controlled machine tools has lagged the West as they have emphasized the large scale production of standardized general purpose machine tools. The Soviets have failed to emphasize the production of special purpose machine tools to the same degree as other industrialized economies. Although this has reduced the productivity of Soviet machine tools, it has enhanced somewhat their transferability and suggests that a substantial part of the annual output of the machine tool sector may be transferable between the defense and the civilian sectors. The Soviet machine tool sector is discussed by James Grant in "Soviet Machine Tools: Lagging Technology and Rising Imports." "Soviet Economy in a Time of Change," A Compendium of Papers submitted to the Joint Economic Committee, Congress of the United States, October 10, 1979, pp. 554–580.

[10] Therefore the elasticity of GNP with respect to defense spending is about .02 and the elasticity of per capita consumption with respect to defense spending is about 0.1.

Figure 1
USSR: DEFENSE SPENDING – ECONOMIC PERFORMANCE TRADEOFFS
ASSUMING ONLY WEAPONS RESOURCES TRANSFERABLE TO
CAPITAL FORMATION, 1981–90



The reason why the effect on GNP growth—the output effect of the resource shift—is so small is that the amount of extra machinery investment obtained by shifting resources out of defense and into investment would be small relative to the size of the Soviet capital stock. The gain in per capita consumption growth would be somewhat larger becasue some of the existing production capacity—through the end use effect—as well as the growth increment is directly transferable to the production of consumer goods.

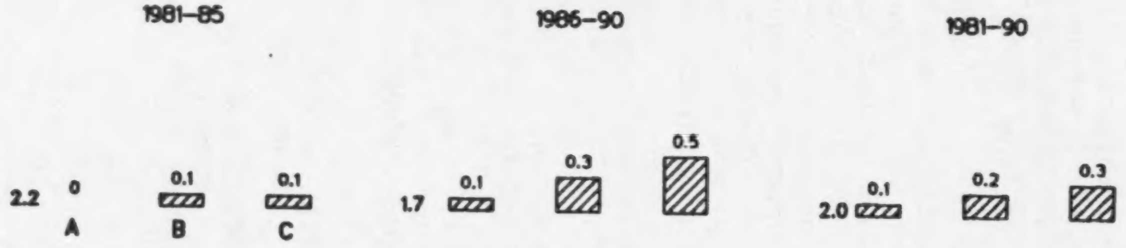
If, on the other hand, average defense spending growth were increased from 4.5 to 9 percentage points per year over the decade, the decline in GNP growth would be small. Per capita consumption growth, however, would be almost one percent per year lower, and living standards would probably fall over the decade. The impact on per capita consumption when defense growth rises is somewhat larger than for a similar reduction in growth primarily because the capital goods transferred to defense in the higher growth case cost the civilian sector more output at the margin than the output gain it would obtain if the defense sector growth were reduced.

For the other special cases, we focus on the impact of a reduction in defense spending growth to zero percent over the remainder of the decade. For these cases, as in Case A, the impacts on economic performance of increasing the annual growth rate of defense spending to 9 percent are roughly the opposite of the impacts of a shift to no growth. The effects on incremental GNP growth and per capita consumption for all the special cases are summarized in figure 2. For ease of presentation, the differential effects are added seriatim.

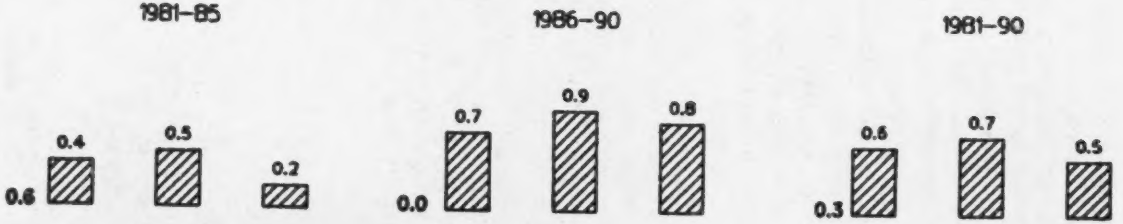
Figure 2

USSR: Impacts of No Defense Spending Growth
on Economic Performance, 1981–90
(average annual growth rates)

Impacts on GNP



Impacts on Per Capita Consumption



A = only weapons production resources transferable to capital formation
B = weapons resources transferable and twice as productive per ruble
C = all defense resources transferable to capital formation and twice as productive

NOTE: The levels are the estimates at a baseline of 4.5 percent defense spending growth, and the bars indicate the impacts with zero defense spending growth relative to the baseline.

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CASE B—WEAPONS PRODUCING RESOURCES MORE PRODUCTIVE

Defense applications claim a disproportionately large share of the best Soviet resources. It is reasonable to assume then that a shift of resources from defense to civilian investment would result in a larger impact than the absolute amount of the shift would suggest. These resources on average would be of higher quality than the average for resources typically devoted to civilian uses. In addition, the defense sector has priority access to supplies and the relatively fewer disruptions defense production experiences adds to their apparently higher productivity. This case looks at the impacts of a shift in defense industrial capacity to civilian production where greater productivity of the defense resources through higher quality and priorities in the supply system are assumed. Although the precise differential in productivity cannot be measured using available data, a reasonable upper bound is the assumption that defense resources are twice as productive per ruble as the average for resources devoted to civilian uses.[11]

Relative to the previous case, the additional increase in both GNP and per capita consumption growth is only about 0.1 percentage point per year over the decade. The issue of greater productivity of defense resources appears to be a secondary factor in analyzing impacts of resource shifts. This follows because it leads to greater per capita consumption growth only through a rise in overall productive capactiy—which is small. The basic potential gain in consumption that comes from slower growth is from the increased claims on output, not from the greater productivity of resources shifted.

CASE C—ALL DEFENSE RESOURCES TRANSFERABLE TO CAPITAL FORMATION AND ARE MORE PRODUCTIVE

Up to now, we have assumed that only the resources shifted from defense procurement to the civilian economy can be used to increase civilian investment. The maximum impact would occur if other resources such as RDT&E are also transferable to investment at a higher productivity than existing civilian capital.[12]

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[11] When analyzing relative productivity, it is important to distinguish between the pricing issue and the efficiency issue. The pricing issue deals with the question of whether there are different pricing rules or prices charged and the civilian sectors; the efficiency issue deals with whether there are differences in the productivity of the resources employed. Although the absolute efficiency of the Soviet defense sector is difficult to assess, it is possible to make some judgments about its relative efficiency. Compared with the United States, the Soviet Union may be less efficient in producing weapons than they are in producing civilian machinery. This comparative disadvantage can be traced both to the inadequacy of their technological base and to the priority treatment the defense sector is accorded. One implication of priority treatment is that Soviet managers will often have large production runs from which a batch of high quality components are selected to obtain the required number of acceptable high quality components. For a discussion of this latter point, see "Prepared Statement of Admiral Stansfield Turner," Allocation of Resources in the Soviet Union and China—1977, Hearings before the Subcommittee on Priorities and Economy in Government of the Joint Economic Committee, Congress of the United States, July 6, 1977, p. 40–41.

[12] Although the Soviet defense sector uses a substantial share of the economy's high technology resources, it is unlikely that that RDT&E resources could be as rapidly transferred to capital formation as this case assumes. Admittedly, these resources could eventually be used to create new high technology investment processes which would enhance the productivity of the Soviet capital stock, say in the area of computer directed machine tools, if there were a highly focused transfer of R&D resources and its priority treatment to the civilian economy. However

Continued

Results show, however, that even if a wider range of defense resources are transferable to civilian capital formation, the overall effect on GNP growth and per capita consumpton remains modest. Over the decade, GNP growth would increase by an additional 0.1 percentage point per year due solely to the assumption of greater transferability. With zero defense growth, all diverted defense resources transferable to investment, and higher productivity of defense resources, GNP growth could be about a third a percentage point higher over the whole decade and a half a percentage point higher for 1985-90.

Surprisingly, the added transferability leads to lower per capita consumption growth over the decade than in the previous two cases. In the other cases, defense resources not transferred to investment are immediately transferred to the consumer. In Case C, however, all defense resources released are transferred directly to capital formation. This implies that the consumer must wait until additional capacity is available to receive the additional benefits. Although per capita consumption rises from expanded productive capacity, it is more than offset by the fall in assumed allocation of output from defense to consumption.

On balance, per capita consumption growth still would benefit from the shift of defense resources. With the full transferability and higher productivity assumptions, growth would be about a half a percentage point greater over the full decade and somewhat less than one percentage point higher for 1985-90.

EFFECT OF BOTTLENECKS ON TRADEOFFS

One characteristic of the taut planning in the Soviet economy is the existence of severe production bottlenecks. These occur when the production of some commodity is constrained by the availability of some material input or service to its production process. In the Soviet Union, constraints on the availability of transportation and ferrous metals, for example, create bottlenecks that have reduced performance in other sectors. Furthermore, as the composition of final demand shifts—for example, more defense and less consumption—the detailed structure of output needed to support this shift may be affected by new bottlenecks created as production is adjusted.

The small macro model used in the above analysis does not take account of changes in bottleneck pressures very effectively. Although it is extremely useful for focusing on the potential effect of defense spending on productive capacity, a macro model incorporates only a general consistency between the production of goods and their final uses. The implicit production balances in such models may be inaccurate if the composition of the final demand changes substantially and new bottlenecks arise. Furthermore, in a

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it would probably take some time for the GNP growth to be impacted; the effects on consumption of such a transfer might not show up for years.

Gur Ofer has discussed the priority treatment received by the Soviet RTD&E sector in "The Relative Efficiency of Military Research and Development in the Soviet Union: A Systems Approach," The Rand Corporation. R-2522-AF, November 1981. He argues that this priority treatment, as a scarce resource, would be dissapated if there was an attempt to reallocate it to the entire economy. However, he feels that significant benefits might be obtained by a well defined sector of the economy, such as the machine building sector, if the treatment were carefully focused on the selected sector.

macro model, the allocation of labor and investment to the different sectors of the economy is usually based on either historical experience or plan data. These allocations may need to change considerably when the composition of final demand changes. These factors would be particularly important under conditions of an absolute reduction in defense spending when large resource shifts and output adjustments would be expected.

Because of these limitations of conventional macro models, a small multi-sector model of the soviet economy was developed to address the trade-off between defense and economic performance under conditions of intersectoral bottlenecks (See Annex for model structure). The focus of this analysis was the extreme conditions associated with absolute reductions in defense spending (negative growth).[13]

If defense spending were to fall by as much as 3 percent a year, per capita consumption could grow more than one percent a year—almost a full percentage point above the current estimate with defense growth at historical levels.[14] Much of this gain, however, could be achieved by a reduction only to zero growth in defense. The increase in consumption from further defense reductions may not be attractive when compared with the serious impacts such absolute cuts would likely have on Soviet defense programs.

III. Some General Observations

There are always uncertainties associated with estimating economic prospects and alternatives over an extended time period. Of particular relevance to this analysis are the uncertain qualitative impacts of transferring substantial quantities of the defense sector's high technology resources to the civilian economy, and the effect of a reduction in defense spending growth on the alleviation of the pervasive micro bottlenecks and disproportions in the civilian sector.

It probably would take more time for the civilian economy to absorb new resources than the analysis implies. Without access to these resources, however, it is going to be extremely difficult for the Soviet economy to break out of its extensive growth trap. Growth performance in the civilian economy will depend heavily on productivity improvements, and without high quality R&D and investment resources little will be forthcoming. Therefore, if one takes a very long run fiewpoint, it might be reasonable to credit the defense sector's high technology resources with the potential for yielding significant civilian returns in the 1990s if a significant transfer were to begin sometime during this decade.

---

[13] The multi-sector model also assumes that capacity in place is not transferable, but workers can be shifted across sectors in the short run. Therefore, one can use the multi-sector model to examine non-incremental defense spending reductions, even if one is unwilling to make any of the transferability assumptions which were applied to the macro analysis.

[14] These estimates are based on the assumptions that procurement resources are no more productive than civilian resources. Assumptions of greater productivity would increase these figures slightly. The effect in per capita consumption growth obtained from this model for small increases or decreases in defense growth around the historical average of 4.5 percent annually are essentially the same as those described in figure 1. However, the cost to consumption is somewhat higher if defense growth were to accelerate because bottlenecks within the industrial materials sector would become serious constraints.

With respect to the micro bottlenecks, if defense spending has overstrained the material supply system and contributed to recent productivity decline, a reduction in the growth of defense might enhance economic performance to a degree not properly reflected in our quantitative estimates. It is difficult, however, to measure the effect of defense spending on this type of bottleneck. The bottleneck and absorption issues suggest that the effect of a reduction in defense spending could be somewhat larger than predicted in the analysis although the gains might also take longer to achieve. It is also important to recognize that this analysis has only focused on defense spending. Of course, there are other policy instruments available to the leadership to improve economic performance. A loosening of the USSR's rigid central planning apparatus, as an example, could promote the process of successful innovation and increase the productivity of capital. Indeed, it is more likely that a broad package of policy changes which included a reduction in defense spending growth as one element would be proposed to revitalize the Soviet economy.

In their deliberations on such a policy package, the Soviet leaders could perceive that a slowdown in defense spending growth would have little impact on the USSR's total military power throughout this decade. Decisions to scale back growth in defense procurement—that is, to reduce somewhat the acquisition rates of new weapons systems—would be unlikely to have a major impact on the overall character of deployed forces until the 1990s. Soviet procurement spending is already large enough to permit substantial modernization and expansion of all major forces. Stretchout of deployment schedules to accommodate somewhat slower growth than originally planned would affect capabilities only at the margin, although even such marginal shortfalls from expected capabilities would not be viewed with equanimity by Soviet military planners. Furthermore, any cutbacks in the growth of RDT&E expenditures would impact primarily on systems to be deployed in the 1990s.

ANNEX—ANALYTICAL FRAMEWORK

Some key features of the models used in this analysis are presented in this Annex.

MACRO MODEL

The macro model was used to establish basic tradeoff relationships under small shifts in resources between defense and the civilian economy. The relationship between the GNP produced, the capital stock (K), and the labor force (N) is summarized with an aggregate production function: $GNP=f(K,N)$. The claims on GNP produced are consumption (C), investment (I), defense (D), and "Other" (Z): $GNP=C+I+D+Z$.

Investment is divided into new fixed investment (Inf), and capital repair (Ikr): $I=Inf+Ikr$. New fixed investment is further subdivided into machinery and equipment investment (Ime) and investment in structures (Is): $Inf=Ime+Is$. Similarly, capital repair is divided into repair of machinery (Irm) and repair of structures (Irs): $Ikr=Irm+Irs$.

New fixed investment augments the capital stock which depreciates at a rate d each year: $K=Inf(-1)+(1-d)K(-1)$, where the (-1) indicates a lag of one year. Capital repair is a fixed proportion b of the capital stock: $Ikr=bK$.[15]

Defense spending is divided into expenditures on weapons (Dw), military personnel (Dp), and other defense expenditures (Do): $D=Dw+Dp+Do$.

Consumption is broken into consumer durables (Cd) and other consumption (Co): $C=Cd+Co$.

The final demand of the machine building sector (Ym) equals the sum of weapons production, machinery and equipment investment, capital repair of machinery and equipment, and consumer durables: $Ym=Dw+Ime+Irm+Cd$.

The model can be solved for values of GNP, K, Co, Ime, Is, Ikr, Irm, Irs that are consistent with assumptions about N, Inf, Dw, Dp, Do, Cd, Z, and Ym.[16]

ALTERNATIVE PRODUCTIVITY ESTIMATES AND CHOICE OF PRODUCTION FUNCTION

Each ruble transferred from defense to capital formation yields a return equal to the marginal product of capital which is calculated from an aggregate production function. As usual, there is some discretion as to both the production function type and the period of estimation used.

The most widely used production function is the Cobb-Douglas which assumes that there is a fixed relationship between the growth of output per worker and the growth of capital per worker. This fixed proportion measures the average responsiveness of output with respect to capital during the estimation period.

In the Soviet Union, the responsiveness of output to infusions of new capital has undergone a marked decline—a structural change that was particularly striking beginning about 1975 within major sectors of the economy.[17] The magnitude of the structural change can be illustrated with the trend in the marginal product of capital (Figure A1). Had the 1966–74 Cobb-Douglas trend continued, the marginal product of capital would not have declined so abruptly around 1975. Figure A1 indicates that the structural change in the Soviet economy reduced the marginal product of capital by about 30 percent in 1975 and later years compared with more straightforward extrapolations.

---

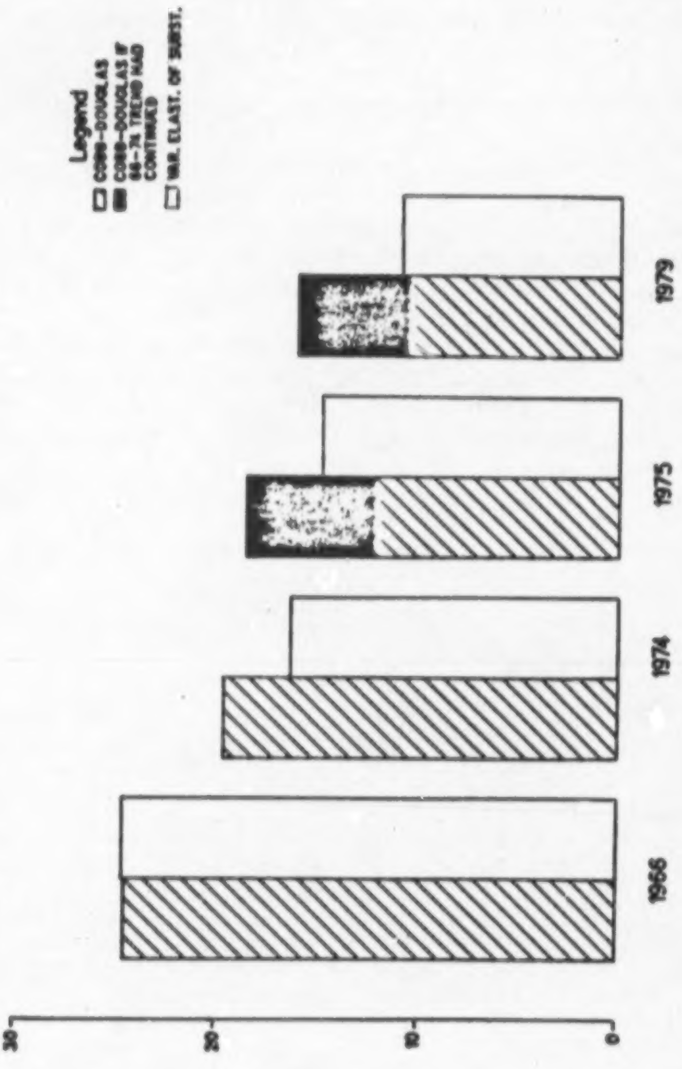
[15] The value of d is estimated to be .0168 from 1960–79 data. The value of b equals .0183—the proportion that applied in 1979. A simple regression of capital repair on the capital stock indicates that both variables are growing at about the same rate. Also, based on Soviet data for 1970, each type of capital repair is assumed to be one half of the total.

[16] New fixed investment is assumed to grow at 1.6 percent a year over the remainder of the decade. This is the growth rate that is implied in the Soviets' 11th Five Year Plan. The values for Ym are obtained from a dynamic simulation of SOVSIM, a macroeconometric model of the Soviet economy which is discussed in SOVSIM: A Model of the Soviet Economy, ER 79-10001, February 1979. For the case in which all defense resources are transferable, the growth rate of total defense spending plus new fixed investment is specified.

[17] Production function analysis for the MBMW, energy, chemicals, ferrous metals, construction materials, construction, and transportation and communications sectors indicates that different Cobb-Douglas production functions apply to the periods 1966–74 and 1975–79.

Figure A1

MARGINAL PRODUCT OF CAPITAL
(percent)



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An alternative approach to estimating Soviet production relationships—the Variable Elasticity of Substitution (VES) production function—does not assume a constant capital-responsiveness of output. Figure A1 also shows the marginal product of capital obtained using this approach. The marginal product of capital obtained using a VES production function shows about the same trend as that obtained using the Cobb-Douglas function for these periods.[18]

Figure A2 presents the estimated growth of Soviet GNP and per capita consumption for the first and second half of the 1980s obtained using a Cobb-Douglas and VES production functions with defense spending growth of 4.5 percent per year. The Cobb-Douglas function predicts an average GNP growth rate of two percent for the 1980s and stagnant per-capita consumption. VES results are slightly more pessimistic. Both approaches indicate somewhat better performance during the first half of the decade than during the second since the return to incremental capital and the growth of the labor force are projected to decline steadily.

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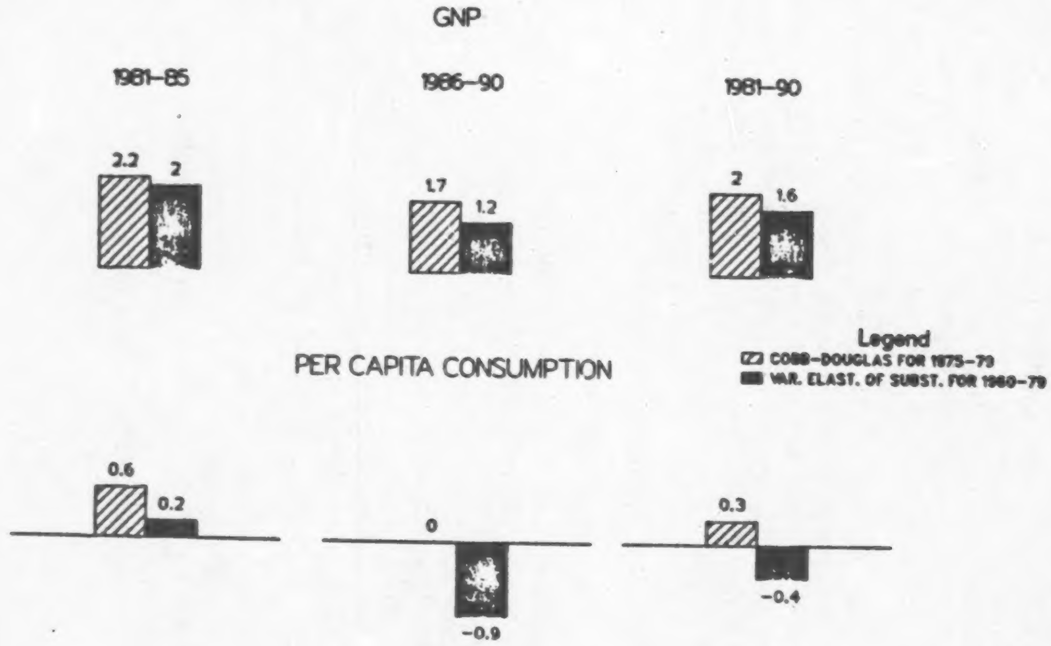
[18] The Cobb-Douglas production functions estimated for 1966–74 and 1975–79 are respectively $\mathrm{LOG}(GNP/N) = -3.24 + .52\mathrm{LOG}(K/N)$ and $\mathrm{LOG}(GNP/N) = -4.07 + .34\mathrm{LOG}(K/N)$. All parameters of these functions are statistically significant at the 5 percent level. Also significant at this level is a parameter which tests whether a structural change occurred in 1975. The significance of this test is justification for using the period 1975–79 as the estimation period with the degrees of freedom calculated using the entire period 1966–79. The VES production function, estimated using 1960–79 data, is $\mathrm{LOG}(GNP/N) = -2.25 + .68\mathrm{LOG}(K/N) - 26.89K/N$. All parameters are again statistically significant at the 5 percent level.

Figure A2

USSR: ALTERNATIVE FORECASTS OF GNP AND PER CAPITA CONSUMPTION GROWTH
(average annual growth rates)



NOTE: defense assumed to grow at 4.5 percent per year

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The tradeoff analysis required selection of a single production function to describe Soviet aggregate economic relationships. Although the VES production function can explain Soviet data over the historical period somewhat more satisfactorily than the Cobb-Douglas production function, this approach assumes that the sharp historical decline in capital responsiveness will continue into the future. As a result, the VES approach may fail to sufficiently credit the Soviets with an ability to arrest the decline in capital responsiveness in the late 1980s, and lead to an overly pessimistic view of Soviet economic potential in the 1980s.

A more balanced approach is to use the Cobb-Douglas function for 1975–79 to describe Soviet economic relationships through the decade.[19] Even though this assumption leads to further declines in captial productivity at the margin, the declines are less severe than would emerge from the use of a VES function and economic prospects are therefore somewhat less pessimistic.

MULTI-SECTOR MODEL

The multi-sector model used to account for bottlenecks under large resource shifts contains the folling sectors:

- Energy
- Civilian Machinery
- Weapons Production and Repair
- Construction
- Industrial Materials and Infrastructure
- Other (Consumer Goods and Services, Agriculture, etc.)

Capital in place is not permitted to be transferred among these sectors. However, the capital stocks are permitted to grow at varying rates by changing the allocation of investment to these sectors.

To depict the general structure of the model, it is helpful to divide the economy into a machine building sector (MBMW) and everything else ("Other"). Figure A3 provides a stylized view of this two sector representation of the complete model.

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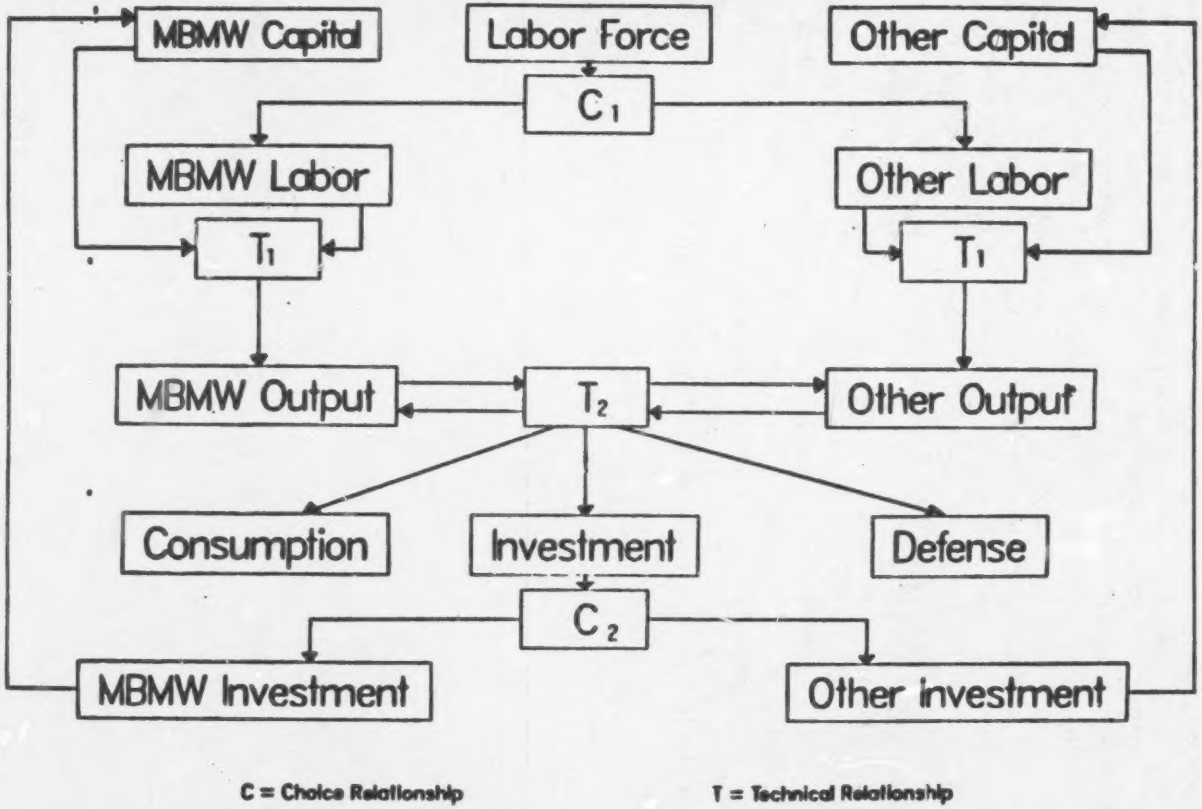
[19] As noted in footnote 19, the actual estimation period was 1966–79 with a test conducted for the presence of a structural change in 1975. There are 10 degrees of freedom associated with this estimation approach.

Figure A-3

STYLIZED MULTI-SECTOR MODEL


MBMW Capital
Labor Force
Other Capital
C_1
MBMW Labor
Other Labor
T_1
T_1
MBMW Output
T_2
Other Output
Consumption
Investment
Defense
C_2
MBMW Investment
Other investment
C = Choice Relationship
T = Technical Relationship

Given values for labor and capital, production functions (T1) determine the output produced in each sector, and input-output relations (T2) establish balances between supply and demand.[20] Each sector's output supports both the other sectors and the needs of consumption, investment and defense. The investment produced in the economy augments the capital stocks of each sector.

To solve the model, a growth rate for defense spending is specified. Labor and investment are then allocated (C1 and C2) to each sector of the economy to maximize the growth rate of consumption subject to both the achievement of a specified level of GNP in 1990 and a balance between supply and demand for each sector's output.

VES functions also provide a somewhat better historical fit for this model than Cobb-Douglas functions, and the trade-off curve obtained using the VES functions suggest much smaller potential gains for consumption for resource shifts. A more balanced approach again is to use Cobb-Douglas production functions in the tradeoff analysis. This recognizes that the capital productivity of the 1960s is unlikely to return, but does not simply extrapolate the sharply declining trend in productivity into the 1980s.[21]

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[20] The input-output coefficients were obtained from a 1970 input-output table of the Soviet economy estimated using 1970 adjusted factor costs.

[21] On 4 March 1983, the New York Times reported that the CIA is revising downward its estimate of the growth of Soviet defense spending for the period 1976–1981. Defense spending may have grown during the period at an annual rate of about 2 percent rather than the 3–4 percent previously estimated. It is unclear, though, whether this represents a change in the long-term trends, or whether the Soviets are gearing up for the production of new weapons. This revision in historical spending estimates would not have a significant effect on the trade-off relationships discussed in this analysis.

IV. ENERGY SUPPLIES AND TRADE

OVERVIEW *

By Ronnie Goldberg

In 1977, the U.S. Central Intelligence Agency issued a report which was widely interpreted as predicting that the USSR—the world's largest oil producer—might well become a net oil importer by 1985. Until recently most of the publicity devoted to Soviet energy focused on the factual and policy debates generated by this report. Now gas—or more specifically, the fate of West Siberian gas pipelines—has replaced oil as the headline grabber. This attention reflects the fact that Soviet energy experts now believe that it is on the production of gas, not oil, that the near and mid-term economic prospects of the USSR depend.

The five papers in this section each address a different aspect of the Soviet energy situation and each, in its own way, sheds light on the reasons for or the implications of the shift in emphasis from oil to gas. The papers have the following basic themes: the prospects for the Soviet gas industry by 1985; the development of CMEA nuclear policy; the structure of Soviet energy consumption; the formulation of Soviet domestic energy policy; and the implications for the Middle East and West of several possible energy-driven Soviet economic and political strategies. Taken together they provide a better understanding of the ongoing changes in the USSR's energy mix and of the implications of these changes for both the Soviet Union and the West.

In his paper on "Near-Term Prospects for the Soviet Natural Gas Industry, and the Implications for East-West Trade," Edward A Hewett points out that natural gas production will be the major determinant of Soviet energy supplies in the first half of this decade. Indeed, the fulfillment of the ambitious gas targets, accounting for 65 percent of the total planned increment to energy supplies by 1985, is critical to the entire Eleventh Five Year Plan (FYP). When oil was considered the key to the Soviet energy future, much discussion and disagreement centered on the size of the USSR's oil reserves and their role as the principal determinant of output. A very different situation exists with respect to gas: one-third of the world's proved natural gas reserves lie in the Soviet Union and the USSR could sustain its planned 1985 levels of gas production well into the 21st century from the reserves of the West Siberian Urengoi field alone.

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* Second vice president, Chase Manhattan Bank.

The feasibility of the Eleventh FYP will ultimately rest on the USSR's ability to build the gas preparation facilities and pipeline system necessary to deliver vastly increased amounts of fuel to consumers in the Soviet Union itself, in Eastern Europe, and in Western Europe. If the project encounters significant delays, these will most likely be due to the cumbersome and inefficient Soviet economic system. Therefore, in the absence of major economic reform, the Soviets will have to guard against the all too familiar kinds of equipment and construction failures that typically plague their economy. Some of these problems may be ameliorated by Western imports, but many will remain.

A good example of the obstacles that even high-priority projects can encounter in the USSR can be found in Lesley Fox's paper on "Soviet Policy in the Development of Nuclear Power in Eastern Europe." The USSR has had an active—and prestigious—nuclear program since the 1950's, and its nuclear industry has expanded impressively during the past five years. Soviet planners see nuclear energy as an increasingly important source of domestic electricity, particularly in the European part of the country where it is expected to account for most of the incremental electricity production in this decade. The Soviet nuclear program has also become a prominent facet of intra-CMEA integration. In the latter regard, it is at once a means of capitalizing upon the various resources of the CMEA nations; a tool for sustaining the economic dependence of the bloc on the Soviet Union; and a source of electricity for the energy-poor and economically troubled countries of Eastern Europe.

But, as Fox's paper documents, in spite of the program's importance, it has been characterized by a persistent gap between goals and accomplishments. Moreover, there is good reason to expect that the USSR's own ambitious targets for nuclear-generated electricity, although attainable in principle, will be underachieved due to the demand for materials, equipment, and labor that the nuclear industry will place on an already burdened economy. To the extent that electricity production falls short of Plan in both the USSR and Eastern Europe, the burden on fossil fuel production and fuel substitution will grow. Such a development will almost certainly increase the importance of gas industry performance.

This assertion is further supported in "Soviet Fuel Consumption: Structure and Future Prospects" by Laura Kurtzweg and Albina Tretyakova. Here, the authors reconstruct a 1972 data base and use it to both describe the structure of Soviet energy consumption in the past decade and develop consumption projections for 1985. Perhaps because of the lack of up-to-date data, most of the attention devoted to Soviet energy in the Western literature has focused on production, particularly of petroleum. This is, of course, only half of the picture. If the USSR shifted its structure of consumption by slowing its rate of energy demand or substituting between different sources of supply, the consequences of slowing growth rates in some energy sources (oil and electricity) and soaring rates in others (gas) could be accommodated.

Kurtzweg and Tretyakova's analysis reveals few reasons for optimism in this regard. The structure of Soviet energy consumption between 1972 and 1980 changed radically with oil replacing coal as the pre-eminent fuel, and gas consumption rising dramatically to almost equal that of coal. If, as widely expected, 1985 production targets are underfulfilled in every area except gas, there is a strong possibility of domestic shortages in electric power and oil products. Assuming no significant improvements in substitution and efficiency, the USSR may be faced with difficult choices involving a combination of the following policies: allowing domestic shortfalls, reducing hard-currency earning energy exports, or slowing economic growth. Thus, the importance of gas as the primary potential source of surplus energy is reinforced. Soviet planners are likely to find gas production their readiest tool for maintaining both exports and domestic consumption.

It is clear from Thane Gustafson's examination of "Soviet Energy Policy" that Soviet decision-makers have recognized this fact. This paper recapitulates the major events of the past ten years of energy decision-making in the USSR, outlines the main features of present policy, and then identifies potential difficulties. In the past, Soviet energy policy has variously centered on coal and oil. Now, Gustafson contends, the present energy program is best characterized as an emergency program based on Siberian gas. This paper augments and reinforces critical points in Edward Hewett's paper. Gustafson points out, for instance, that it is possible that the gas and pipeline projects planned for 1985 could absorb as much as ten percent of the entire Soviet investment budget for the Eleventh FYP.

Clearly, with such enormous stakes riding on the performance of the gas industry and with the rapid reallocation of resources that such prioritization has entailed, the risks of failure are great. According to Gustafson, these risks are that the demanding targets for gas output and transmission may not be met, and that severe shortfalls may occur in other energy sectors. The latter problems would be troublesome even if the USSR could achieve its gas plan, since rigidities in the consumption structure (and indeed in the economy as a whole) could inhibit the substitution of gas for other fuels. In other words, "by the Mid-1980's the Soviets could end up simultaneously with a gas glut and a shortage of everything else." Success will therefore depend on a complex and delicate approach that would not only aim at achieving gas targets, but would simultaneously address in a balanced fashion production of other energy sources and the problem of substitution.

The implications for the West of the Soviet energy situation that is outlined here can be approached through the analysis presented in Jonathan P. Stern's paper "CMEA Oil Acquisition Policy in the Middle East and the Gulf: The Search for Economic and Political Strategies". This paper traces the history of the interaction of oil and Soviet Mid-East policy since the early 1970's and discusses the outlook for the eighties.

Stern's themes emerge from his basic contention that the most severe repercussions of a Soviet energy shortage will fall on Eastern Europe, not on the USSR. This will happen because the countries of Eastern Europe, which have in the past relied heavily on subsidized Soviet oil, are increasingly being pushed onto world oil markets. Eastern Europe's need to purchase oil with scarce hard currency at prevailing world prices is the result of the slowing—

indeed virtual flattening—growth rate of Soviet oil production. Unless gas can become the major hard currency earner, the USSR will be forced to chose between supplying Eastern Europe and exporting outside the CMEA for hard currency. Indeed, the choice has already been made. For some time, Soviet policy has been moving toward making available to CMEA countries less oil at higher prices. Moreover, it is not clear that the complete success of all Soviet gas projects would completely eliminate this situation. Once again, limitations on fuel substitution will leave Eastern Europe vulnerable to growing oil demand, while the structure of the Soviet economy may well produce a domestic market eager to absorb the dwindling increment in oil production.

It is in this context that Stern considers the policy options facing the USSR, assuming that it would seek to acquire oil on concessionary terms for its allies. The available options range from adopting a "watch and wait" attitude (in which the USSR would allow events in the Persian Gulf—and particularly in Iran and Iraq, the major Middle East suppliers of oil to Eastern Europe—to take their course and position itself to capitalize politically on turmoil in the region) to outright military intervention. In the latter case, the acquisition of oil seems neither a necessary nor a sufficient condition for such drastic Soviet action. Stern believes that the likeliest course is somewhere between, in a policy of "low level intervention" which would allow the USSR to quietly encourage and then exploit instability.

If one accepts this conclusion, the fate of Soviet gas production and delivery takes on a more ominous aspect. To oversimplify: the threat to world peace and Western interests of a Soviet Union with fuel substitution problems is real enough. The potential magnitude of such a threat should the USSR be faced with the collapse of its Five Year Plan, its entire energy program, and its prospects for acquiring badly needed hard currency would seem vastly increased. Yet, the preponderance of the material in these papers suggests that such a collapse would be possible with the failure of the current gas program. This is by no means to assert that delays in the gas pipeline project would foreshadow, even less cause, the failure of the enormous Soviet economy, which may not be flexible but at least appears to be highly resilient. It is to suggest that this project deserves the attention it has been accorded and can hardly fail to have significant impacts on both the economic position and political policies of the USSR in the near and mid-term.

SOVIET ENERGY CONSUMPTION: STRUCTURE AND FUTURE PROSPECTS

By Laurie Kurtzweg and Albina Tretyakova [*]

CONTENTS

Page
I. Summary 355
II. Introduction 357
III. Soviet energy consumption in 1972 358
  Major characteristics of data base 359
  Structure of energy consumption in 1972 364
IV. Trends in Soviet energy consumption to 1980 367
V. Method for projecting Soviet energy consumption 369
  Influences on Soviet energy requirements 370
  Summary of projection method 370
VI. Estimates of future Soviet energy balances 379
  Test of consistency of the Eleventh FYP 380
  Effects of differences between plan and performance 387

TABLES

1. USSR: Structure of energy use in 1972 365
2. USSR: Estimates of domestic energy consumption under Eleventh FYP conditions, 1985 381
3. USSR: Comparison of projected domestic energy consumption and projected availability of energy under plan, 1985 387
4. USSR: Comparison of Five-Year Plans and results for production of energy 388
5. USSR: Shares of types of fuel in total fuel consumption for conversion to power 389

FIGURES

1. Schematic of 1972 Soviet energy consumption data base 360
2. Format of 1972 Soviet energy consumption data base 361
3. Alternative measures of energy consumption 363
4. Trends in apparent consumption of major types of energy 368
5. Schematic diagram of projection method 372
6. Comparison of observed energy consumption with initial and adjusted estimates 374
7. Trends in production, apparent consumption and net exports of energy 383

I. SUMMARY

The Soviet energy balance plays a critical role in determining Soviet economic potential. Soviet production of energy, especially of oil and gas, grew rapidly in the past decade. This growth not only covered the energy requirements of an expanding domestic economy but also permitted substantial increases in net exports. Growth in production, however, has slowed in the second half of the decade, and the Eleventh Five-Year Plan (FYP) for 1981–85 points toward a continued slowdown. Within this overall trend, slower growth is planned for oil and electric power production, while both gas and coal are slated to grow at rates close to those achieved over the past ten years.

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Because it is likely to continue, the recent slowdown in growth raises an important question. Will domestic energy production during the first half of the present decade be adequate to cover domestic requirements and maintain exports at about current levels? This paper examines the possible shape of future Soviet energy balances by comparing projections of domestic demand with projections of supplies available to the domestic economy. The consistency of the Eleventh FYP with respect to energy is tested by comparing demand and supply projections derived from plans. Also, the effects of some possible differences between plan and likely performance on both supply and demand are assessed.

To test the consistency of the Soviet Eleventh FYP, projections of energy supplies are obtained by adjusting official production plans to exclude assumed levels of net exports. The assumptions reflect conservative judgments about minimum political and contractual commitments to foreign purchasers. Demand projections are made by relating domestic consumption to planned growth in the energy-consuming sectors and to planned trends in interfuel substitution in electric power generation. Changes in substitution for uses other than power generation and changes in efficiency are extrapolated according to past trends. While projected demand in 1985 is slightly greater than projected supply for coal and slightly less for oil products and gas, all three differences are within a reasonable margin of error associated with the projection method. For electric power, however, projected demand exceeds projected supply by 9 percent. Unless past trends in substitution of power consumption for direct fuel use are checked, perhaps by above-trend increases in efficiency, domestic shortages of power are likely by mid-decade.

The energy balance picture changes, however, when likely differences between plans and actual performance are taken into account. On the supply side, plans for energy production in recent FYP periods have usually turned out to be overambitious, and this is a likely outcome for the current FYP as well. On the demand side, two kinds of differences between plan and performance can be expected to affect the consumption estimates. Goals for growth of the energy-consuming sectors are likely to be overstated. The effect of this will be to lower actual demand in 1985 compared with the estimates based on Soviet plans. Also on the demand side, interfuel substitution in electric power generation is not likely to occur to the very ambitious extent currently planned. This will not affect demand for power but will tend to push actual future consumption above the plan-based estimates for oil products, where decreases in shares are slated, and below the estimates for coal and gas, where increases in shares are planned.

The net result of failure to meet plan goals in energy production, growth of the energy-consuming sectors, and interfuel substitution in power generation can be evaluated under "worst-imbalance" assumptions about divergences of performance from plan. Under these conditions, the projected balance for coal in 1985 would be maintained, and the projected imbalance for electric power would be reduced but probably not eliminated. There would be a substantial surplus of gas by 1985, but a shortage would develop for oil products. The potential for domestic shortages of electric power and oil products by mid-decade therefore appears strong.

If the share of oil products in total consumption of fuels for electric power generation were not decreased as planned but maintained at about its current level, demand for oil products could exceed supply by about 10 to 15 percent in 1985. Soviet planners could respond to a shortage of this size by letting inventories and exports absorb the full impact. If cutbacks in these final uses were unacceptable, however, or could provide only a temporary fix, consumption by producing sectors would be affected and domestic economic performance would suffer.

In the case of electric power, the Soviets may have to break past trends in substitution of power consumption for direct fuel use to avoid shortages by mid-decade. If ratios of power consumption to economic activity were not to increase at recent rates but remain at current levels, demand for electric power could be held approximately equal to supply in 1985. But Soviet planners might find it difficult to limit the effects on economic growth of such a break in trends in power consumption. Increases in efficiency, perhaps supplemented by substitution of direct fuel use for power, would have to be implemented at rates faster than past trends.

II. Introduction

The Soviet energy balance plays a critical role in determining Soviet economic potential. Soviet production of energy, especially of oil and gas, grew rapidly in the past decade. This growth not only covered the energy requirements of an expanding domestic economy but also permitted substantial increases in net exports. Growth in production, however, has slowed in the second half of the decade, and the Eleventh Five-Year Plan (FYP) for 1981–85 points toward a continued slowdown. Within this overall trend, slower growth is planned for oil and electric power production, while both gas and coal are slated to grow at rates close to those achieved over the past ten years.

Because it is likely to continue, the recent slowdown in growth raises an important question. Will domestic energy production during the first half of the present decade be adequate to cover domestic requirements and maintain exports at about current levels? This paper examines the possible shape of future Soviet energy balances by comparing projections of domestic demand with projections of supplies available to the domestic economy. The consistency of the Eleventh FYP with respect to energy is tested by comparing demand and supply projections derived from plans. Also, the effects of some possible differences between plan and likely performance on both supply and demand are assessed.

Although official Soviet plans for energy development to 1985 include detailed information on production, domestic consumption, and net exports, published information on plans is limited mostly to production, and even then only for a few major types of energy. Despite the effort Soviet planners devote to balancing, the past record of failures to achieve plans suggests that future imbalances between supply and demand will themselves pose problems. The possibility of such imbalances is the focus of much of the analysis in this paper.

The paper's projections of future Soviet energy balances rely heavily on information from the 1981-85 plan. Projections of energy supplies available to the domestic economy are developed in a straightforward manner. In the absence of information on foreign trade plans, official plans for production are adjusted to exclude assumed levels of net exports. The assumptions reflect conservative judgments about minimum political and contractual commitments to foreign purchasers. Projections of domestic demand are made by relating consumption to planned growth of the energy-consuming sectors and to planned trends in interfuel substitution in power generation. As in much Western and Soviet analysis of energy demand, the dependence of energy requirements on economic activity is fundamental. The dependence can be analyzed in aggregate or in detail, or in some intermediate degree of disaggregation. The approach here incorporates much more detail than has been available for previous Western studies of Soviet energy.

The starting point for the demand projections is a new data base that describes the structure of Soviet energy consumption in 1972. The breakdown of consumption is available by type of energy, by consuming sector, and by energy-using process within each sector. The data base is then combined with more recent but less detailed time-series data to gain insights into past trends in aggregate energy consumption. For projections of future energy consumption, the time-series data are extended with information from the 1981-85 plan. Because the plan calls for sharp changes from past trends in substitution among fuels used for power generation, it is important that the projections take these changes into account.

The next section of this paper describes the data base on Soviet energy consumption in 1972. Then trends in energy consumption during the 1970s are reviewed briefly, and the method for projecting domestic consumption in 1985 is summarized. Finally, the possible shape of energy balances in 1985 is examined by comparing the consumption projections with projections of supplies available to the domestic economy. Most of the discussion focuses on the consistency of the Eleventh FYP with respect to energy, but the effects of some possible differences between plan and performance are also assessed.

III. SOVIET ENERGY CONSUMPTION IN 1972

The data base on energy consumption is derived by combining energy information from two major Soviet sources: the input-output (IO) table for 1972 and fuel-energy (FE) balances for 1970 and 1975.[1] Control totals for the estimates in the data base are

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[1] Although the table has never been published in full in Soviet sources, it has been reconstructed by a group of Western researchers. The version used to derive the data base is the most detailed available, including 88 intermediate sectors, 7 categories of value added, and 5 categories of final demand. See Dimitri M. Gallik, Barry L. Kostinsky, and Vladimir G. Treml, "Input-Output Structure of the Soviet Economy: 1972" (U.S. Department of Commerce, Bureau of the Census, Foreign Demographic Analysis Division, Foreign Economic Report, forthcoming).

Continued

taken from the IO table. Additional information from the FE balances allows an expansion of the level of detail beyond that of the IO table and also provides a basis for improved measurement of energy consumption. The major characteristics of the data base are reviewed below, and some highlights of the new information on the structure of energy consumption are discussed.[2]

MAJOR CHARACTERISTICS OF DATA BASE

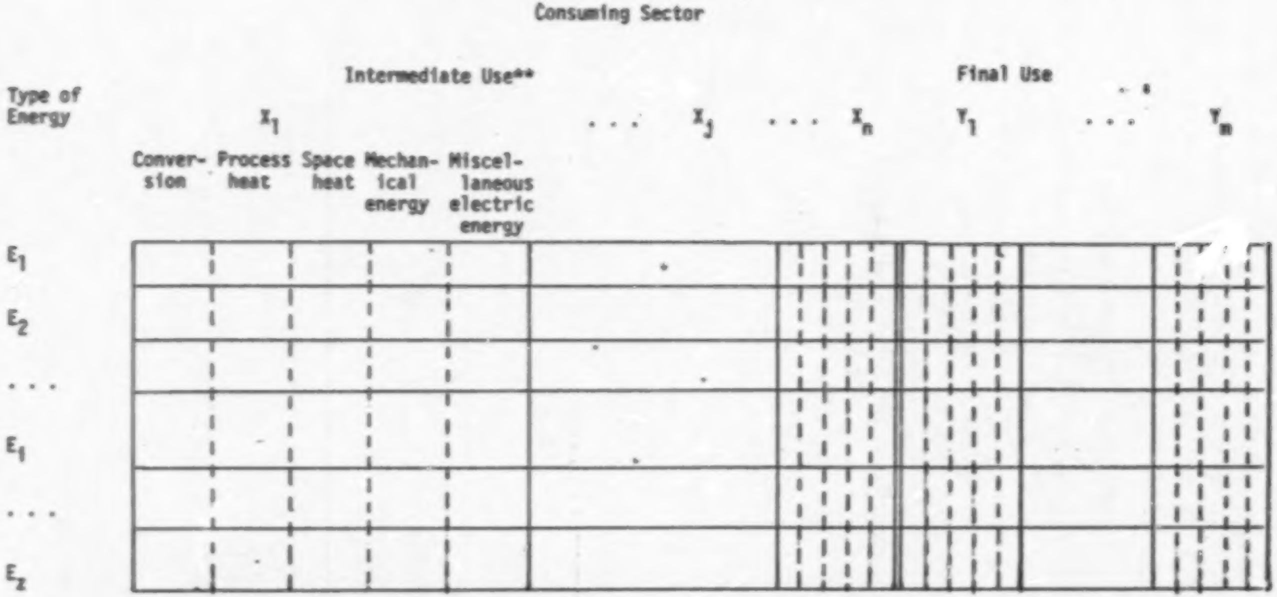
The new 1972 data base describes the structure of Soviet energy consumption in greater detail than has been available previously: detail by type of energy, by consuming sector, and by energy-using process within each sector. The data base is arranged in tabular form: rows represent types of energy and columns represent consumers of energy. Within each consuming sector, the data base also shows a breakdown into technologically distinct energy-using processes (see figure 1).

Like IO tables, FE balances are not published in full in Soviet sources. Reconstructed versions are available in Robert Campbell, Soviet Energy Balances (Santa Monica, Cal., Rand Corporation, R-2257-DOE; Dec. 1978, prepared for the U.S. Department of Energy).

[2] The derivation of the data base is outlined in an appendix available on request. The appendix also includes detailed tables of the estimates of energy consumption developed for the data base.

Figure 1

Schematic of 1972 Soviet Energy Consumption Data Base*


Consuming Sector
Intermediate Use**
Final Use
Type of Energy
X_1
. . .
X_j
. . .
X_n
Y_1
. . .
Y_m
Conver-sion
Process heat
Space heat
Mechanical energy
Miscellaneous electric energy
E_1
E_2
. . .
E_i
. . .
E_z

* Each entry in the table shows the amount of a particular type of energy used in a specific process in each intermediate or final consuming sector.

** The intermediate sectors that use energy include the sectors that produce energy.

Figure 2 lists the full detail of the types of energy and consumers of energy identified in the data base. There are rows for 42 types of energy and columns for 26 consuming sectors, of which 20 are intermediate and 6 final consumers.[3]

Figure 2

Format of 1972 Soviet Energy Consumption Data Base

Types of Energy

1. Coal
   - Anthracite
   - Coking coal
   - Other hard coal
   - Brown coal
   - Cleaned coal, for coking
   - Cleaned coal, for energy use
   - Other cleaned coal
   - Screened anthracite
   - Briquets
   - Recovered waste
2. Crude oil
   - Crude oil
   - Associated gas
   - Unstable gasoline
   - Non-fuel products
3. Oil products
   - Aviation gasoline
   - Motor gasoline
   - Tractor kerosene
   - Illuminating kerosene
   - Jet fuel
   - Gas-turbine fuel
   - Diesel fuel
   - Residual fuel oil, furnace
   - Residual fuel oil, fleet
   - Refining gas
   - Non-fuel products
4. Gas
   - Natural gas
   - Manufactured gas
   - Liquefied gas
   - Dry gas
   - Gas condensate
   - Stable gas condensate
   - Natural gasoline
   - Non-fuel products
5. Peat
   - Lump peat
   - Shredded peat
   - Peat briquets
   - Agricultural peat
   - Non-fuel products
6. Oil shales
   - Oil shales
   - Non-fuel products
7. Electric power
   - Electric power
   - Thermal power

Consuming Sectors

Intermediate Users

1. Metallurgy
2. Coal
3. Crude oil
4. Oil products
5. Gas
6. Peat
7. Oil shales
8. Electric power
9. Machinery
10. Chemicals
11. Wood and paper
12. Construction materials
13. Light industry
14. Food industry
15. Other industry
16. Construction
17. Agriculture
18. Transportation and communications
19. Trade
20. Other branches

Final Users*

21. Private consumption
22. Passenger transportation
23. Other public consumption
24. Other domestic final demand
25. Exports
26. Imports

*Private consumption covers all energy use by persons, including energy for residential space heat and other utilities billed to individuals and energy for passenger transportation in privately owned vehicles. The passenger transportation sector includes all energy for passenger transportation in public vehicles. Other public consumption covers all energy use by state organizations serving the population, including energy for space heat and other utilities billed to organizations. Other domestic final demand includes net change in inventories and military use of energy.

The data base also identifies five technologically distinct processes in which energy is used:

1. *Conversion.*—Fuel is not used directly but is first converted to electric or thermal power, that is, to electricity or heat in the form of steam or hot water. Conversion can take place either centrally as in the electric power sector or at small installations in other sectors for their own use.

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[3] The types of energy identified can be aggregated into 7 rows matching those of the largest IO table available. The intermediate consuming sectors identified correspond roughly to the standard Soviet classification by branch of industry and the economy, with additional detail for the energy sectors. It should be emphasized, however, that the correspondence is only rough. The data base follows the IO classification of branches of industry, which differs in a number of important respects from the standard classification used for such annual accounts as gross value of industrial output.

2. *Process heat.*—Fuel or power is used to provide heat energy for technological processes required to produce the output of the consuming sector. Energy consumed in blast furnaces by the metallurgy sector is an example.

3. *Space heat.*—Fuel or power is used to provide heat energy for general heating and cooling of buildings. The energy input is not directly associated with production of the output of the consuming sector.

4. *Mechanical energy.*—Fuel or power is used to provide mechanical energy for operating stationary or mobile equipment. Energy consumption in railroad engines by the transportation sector is an example.

5. *Miscellaneous electric energy.*—Electric power is applied directly, that is, not transformed into heat or mechanical energy, in a variety of miscellaneous processes and in lighting.

The 1972 data base provides not only conventional measures of energy consumption including losses but also net measures of consumption that exclude losses in each using sector and process (see figure 3). Three basic measures of energy consumption are available:

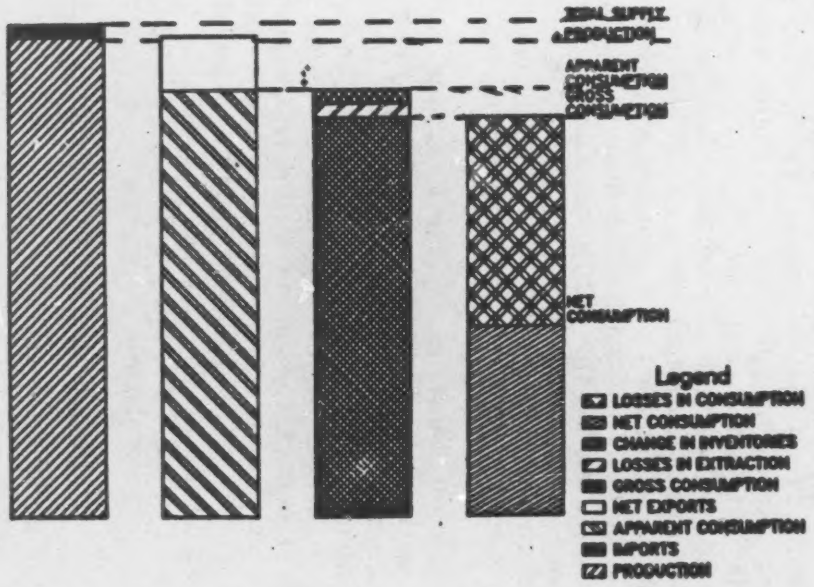
Apparent consumption is defined as production plus imports minus exports. The term "apparent" signals that this measure adjusts for only part of the difference between production and "actual" consumption.

Gross consumption is defined as apparent consumption minus net increase in inventories minus losses during extraction and transportation. The term "gross" indicates that losses at later stages of the energy system are not subtracted.

Net consumption can be defined in either of two equivalent ways: as the amount of useful work obtained when energy is consumed or as gross consumption minus losses at stages after extraction and transportation. Its measurement is important because ratios of net to gross consumption can be analyzed to evaluate the efficiency of energy use.

Variants of all three measures are possible depending on whether double counting of consumption by the energy sectors themselves is included.

FIGURE 3
ALTERNATIVE MEASURES OF ENERGY CONSUMPTION



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The distinctions between the basic measures of consumption deserve some expansion. Data in physical units, such as tons of coal or cubic meters of natural gas, are the starting point for all three measures. Apparent and gross consumption are converted to heat-equivalent units by taking into account differences among types of energy in the amount of heat that can be obtained from them under uniform, controlled conditions. These essentially laboratory conditions are designed to measure the maximum amount of heat that can be derived from the combustion of a unit of the type of fuel in question. In the data base both apparent and gross consumption are measured in units of Soviet "standard fuel." One ton of standard fuel is defined as 7 gigacalories, which is the amount of heat produced by burning one ton of coking coal under ideal conditions.[4]

Net consumption estimates start from gross consumption in heat-equivalent units, available by type of energy and consuming sector. Gross consumption is first broken down further into consumption by technologically distinct processes within each sector. These estimates are then multiplied by efficiency coefficients differentiated by type of energy, consuming sector, and technological process to yield estimates of net energy consumption. An efficiency coefficient can be defined as the ratio of the output of useful work, or net consumption, to the associated input of energy, or gross consumption. In Soviet studies of efficiency both net and gross consumption are measured in gigacalories.

STRUCTURE OF ENERGY CONSUMPTION IN 1972

Some highlights of the new information included in the data base on the structure of Soviet energy consumption are discussed below. Table 1 shows distributions of output for four major types of energy: coal, oil products, gas, and electric power.[5] In these distributions the breakdown of energy-consuming sectors is shown in full detail, but the breakdown of energy-using processes within each sector is omitted.

The sum of each distribution in table 1 is total production, except that unprocessed fuels used to produce processed fuels are excluded both from production and from consumption by the energy sectors themselves. For purposes of the discussion below, an individual consuming sector is considered a major user of some type of energy if its share of production of that type is 5 percent or greater.

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[4] One gigacalorie is defined as 1 billion calories.

[5] Each of the four major types corresponds to an energy row of the IO table. One difference in coverage, however, should be noted. Most IO energy rows include miscellaneous non-fuel products that cannot be measured in terms of heat equivalents. For example, asphalt is included with oil products and helium is included with gas. The distributions discussed below exclude these non-fuel products, which are unimportant except in the IO row for oil products.

Henceforth, the terms "electric power" and "power" should be understood to include heat in the form of steam and hot water as well as electricity. As in IO tables, the electric power sector in the data base includes all electricity and heat produced by enterprises subordinate to the Ministry of Energy and Electrification. But it includes electricity and heat produced by enterprises subordinate to other ministries only to the extent that their output is sold to outside purchasers.

TABLE 1a.—USSR: STRUCTURE OF ENERGY USE IN 1972

[Amount of Use in Heat-Equivalent Units]

[Million tons standard fuel]

Consuming sector	Coal	Oil products[2]	Gas	Electric power[3]
Intermediate users:				
Metallurgy	142.9	10.8	35.2	17.6
Coal	14.8	.7	0	4.4
Crude oil	(1)	.5	1.5	1.4
Oil products	(1)	5.5	10.8	9.6
Gas	(1)	.4	4.0	.4
Peat	(1)	.4	0	.1
Oil shales	0	(1)	(1)	.1
Electric power	132.9	75.4	73.5	7.1
Machinery	11.5	19.5	19.7	12.4
Chemicals	2.7	3.7	28.0	30.6
Wood and paper	7.7	9.6	2.2	3.1
Construction materials	16.1	3.3	24.4	9.4
Light industry	2.6	1.2	2.6	9.5
Food industry	11.3	15.4	6.9	5.7
Other industry	3.0	.9	5.3	2.6
Construction	7.6	19.3	2.2	3.2
Agriculture	10.3	57.8	1.3	4.2
Transportation	9.2	53.8	9.1	5.7
Trade	5.9	2.0	1.4	2.1
Other branches	.2	.2	.1	0
Final users:				
Private consumption	21.6	6.2	12.6	30.7
Passenger transportation	0	20.6	0	1.8
Other public consumption	43.7	0	34.1	24.3
Other domestic final demand	2.1	36.2	1.2	0
Exports	22.8	42.5	6.0	.9
imports	−9.2	−1.3	−12.9	0
Gross output[4]	459.8	384.5	269.1	186.9

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[1] Less than 0.05.

[2] The term "oil products" should be understood to exclude miscellaneous non-fuel products, such as asphalt, that cannot be measured in terms of heat equivalents.

[3] The term "electric power" should be understood to include heat in the form of steam and hot water as well as electricity.

[4] Sum is equal to total production, except that unprocessed fuels used to produce processed fuels are excluded both from production and from consumption by the energy sectors themselves.

As table 1 shows, energy use in 1972 was dominated by a few consuming sectors that were major users of at least two of the four types of energy shown. Not surprisingly, electric power used substantial amounts of all three fuels, ranging from 20 percent of the output of oil products to 27 and 29 percent of the outputs of gas and coal, respectively. Two other intermediate sectors were major users of three types of energy: metallurgy (coal, gas, and electric power) and machinery (oil products, gas, and electric power). Metallurgy, although the smaller sector in terms of value of output, was the larger consumer of energy by a sizable margin. Chemicals and construction materials were major users of the same two types of energy: gas and electric power. Although these sectors were of medium size in terms of value of output, each consumed about as much total energy as the machinery sector. Among the final

TABLE 1b.—USSR: STRUCTURE OF ENERGY USE IN 1972

[Structure of Use in Heat-Equivalent Units]

[Percent]

Consuming sector	Coal	Oil products [2]	Gas	Electric power [3]
Intermediate users:				
Metallurgy	31.1	2.8	13.1	9.4
Coal	3.2	.2	0	2.4
Crude oil	([1])	.1	.6	.7
Oil products	([1])	1.4	4.0	5.1
Gas	([1])	.1	1.5	.2
Peat	([1])	.1	0	([1])
Oil shales	0	([1])	([1])	([1])
Electric power	28.9	19.6	27.3	3.8
Machinery	2.5	5.1	7.3	6.6
Chemicals	.6	1.0	10.4	16.4
Wood and paper	1.7	2.5	.8	1.7
Construction materials	3.5	.8	9.1	5.1
Light industry	.6	.3	1.0	5.1
Food industry	2.5	4.0	2.6	3.1
Other industry	.7	.2	2.0	1.4
Construction	1.7	5.0	.8	1.7
Agriculture	2.3	15.0	.5	2.2
Transportation	2.0	14.0	3.4	3.1
Trade	1.3	.5	.5	1.1
Other branches	([1])	([1])	([1])	0
Final users:				
Private consumption	4.7	1.6	4.7	16.4
Passenger transportation	0	5.4	0	1.0
Other public consumption	9.5	0	12.7	13.0
Other domestic final demand	.4	9.4	.4	0
Exports	5.0	11.1	2.2	0.5
Imports	−2.0	−.3	−4.8	0
Gross output [4]	100.0	100.0	100.0	100.0

[1] Less than 0.05.

[2] The term "oil products" should be understood to exclude miscellaneous non-fuel products, such as asphalt, that cannot be measured in terms of heat equivalents.

[3] The term "electric power" should be understood to include heat in the form of steam and hot water as well as electricity.

[4] Sum is equal to total production, except that unprocessed fuels used to produce processed fuels are excluded both from production and from consumption by the energy sectors themselves.

demand categories, public consumption (excluding passenger transportation) was a major user of coal, gas, and electric power.[6]

Table 1 also shows the types of energy in decreasing order of size, as measured by either production or apparent consumption in 1972. The largest of the four, coal was distributed to fewer major users than the other types. Metallurgy, electric power, and other public consumption were the three largest consumers, accounting for nearly 70 percent of ouput. Private consumption and exports took up just under 5 percent each, while all other consumers used smaller shares.

The largest consumer of oil products was electric power, which used 20 percent, followed by agriculture (15 percent) and transportation (14 percent). The latter two sectors, it may be noted, were not major users of any other type of energy. Three more consumers used 5 percent each: machinery, construction, and passenger transportation. Finally, increases in inventories accounted for 9 percent of output and exports for 11 percent.

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[6] Although other public consumption used more energy than most branches of industry, its energy use was small in comparison with total consumption by all branches of industry.

As with oil products, electric power was also the largest consumer of gas, using 27 percent of output in 1972. The shares of the other major users were no more than half as large, ranging from 7 to 13 percent for metallurgy, other public consumption, chemicals, construction materials, and machinery. Private consumption and imports each accounted for just under 5 percent of gas output.

Electric power had a wider distribution of use than any of the fuels. Private and other public consumption took up 16 and 13 percent of output, respectively. Of the intermediate users, only the chemicals sector accounted for as large a share (16 percent). Metallurgy followed, using 9 percent of output, while four sectors—machinery, oil products, construction materials, and light industry—had shares ranging from 5 to 7 percent.

The 1972 data base provides not only conventional measures of energy consumption including losses but also net measures that exclude losses in each using sector and process. Ratios of net to gross consumption can then be applied to analyze the efficiency of energy use at the process and sector levels. Differences in the efficiency with which the same type of energy is consumed by different sectors depend both on differences in the efficiency of similar processes across sectors and on differences in the mix of processes within sectors. For example, the high temperatures required for heat energy used directly in the production of metals made metallurgy an inefficient consumer of coal, gas, and electric power relative to other sectors. Examples of the effects of process mix can be found in consumption of oil products by agriculture and transportation (both freight and passenger), which were relatively inefficient because of the large share of mechanical energy in their use. A counter-example can be seen in consumption of gas by the electric power sector, which was relatively efficient because of the large share of conversion in its use.

IV. TRENDS IN SOVIET ENERGY CONSUMPTION TO 1980

Information on trends in Soviet energy consumption is of course more limited than the detailed information in the 1972 data base. Because the availability of data influences the development of the projection method, information on trends during the past decade is briefly reviewed below.

Annual observations of aggregate consumption of energy in the Soviet economy as a whole can be obtained for each major type of energy. The trends are illustrated in figure 4. Because information on trends in inventories and losses is inadequate for measures of gross and net consumption, apparent consumption is the measure discussed.[7]

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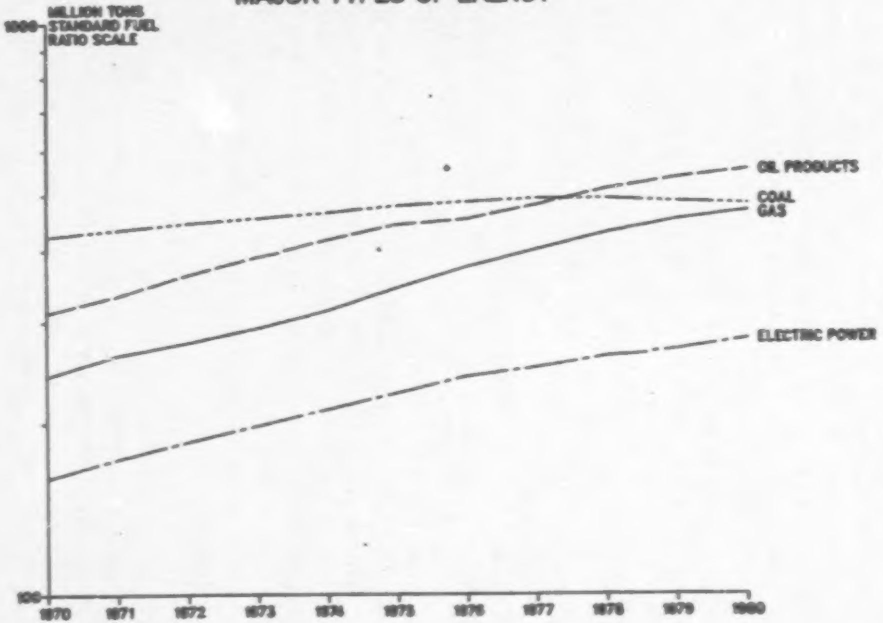
[7] The derivation of the observations of apparent consumption is discussed in a footnote to the text below.

FIGURE 4
TRENDS IN APPARENT CONSUMPTION OF
MAJOR TYPES OF ENERGY



Aggregate apparent consumption of all major types of energy increased between 1970 and 1980 at rates that differed depending on the type. While coal consumption grew slowly (at an average annual rate of 1.3 percent), consumption of oil products and electric power grew much faster (at 5.6 percent and 5.9 percent, respectively), and gas consumption grew fastest of all (at 6.9 percent). The relative shares of the types of energy therefore changed markedly. At the beginning of the decade consumption of the major fuels was dominated by coal (43 percent), trailed by oil products (32 percent) and then gas (25 percent). Consumption of electric power was 17 percent of consumption of the major fuels. By the end of the decade oil products accounted for the largest share (37 percent) of fuel consumption, followed by coal (32 percent) and gas (31 percent). Power consumption increased to 19 percent of fuel consumption.

Information on trends in energy consumption by sectors defined in the same way as the sectors identified in the data base is not readily available. Trends for major branches of the economy can be obtained from FE balances, but it should be recognized that even the definitions of major branches differ somewhat from those in the data base. Moreover, some of the information for 1980 is still preliminary. Nevertheless, the directions and rough magnitudes of the trends indicate that the structure of energy consumption changed gradually, not radically. The shares of industry, construction, agriculture, transportation, and final use in total consumption of all major types of energy together remained quite stable. Industry consumed an increasing share of coal and oil products but a decreasing share of gas and electric power. In a mirror image of the trends in industry, agriculture and final use consumed decreasing shares of oil products (final use also consumed a decreasing share of coal) but increasing shares of gas and electric power.

Although detailed information on trends in efficiency in energy use also is available only on a selective basis, aggregate information points toward increases in efficiency both in consumption and in extraction and processing. The efficiency of direct fuel use relative to electric power consumption remained quite stable between 1965 and 1975, as did the efficiency of energy consumption by major branches of the economy relative to each other. Substitution of oil products and gas for coal was probably responsible in large part for the increases in efficiency that took place.

V. Method for Projecting Soviet Energy Consumption

The present method for projecting Soviet energy consumption combines the detailed 1972 data base with less detailed time-series data and published information on the current FYP. With the aid of the 1972 data base, consumption estimates for 1970 to 1985 are built up from a highly disaggregated level. Because of the limited availability of detailed information on trends, however, the estimates for 1970 to 1980 are checked only against aggregate observations. These checks serve to establish trends in interfuel substitution and efficiency that can be used along with FYP information to develop projections for 1985.

INFLUENCES ON SOVIET ENERGY REQUIREMENTS

As in market economies, levels of economic activity exert a major influence on energy demand in the Soviet system. Consider the demand by some consuming sector for energy of a given type. In the view of Soviet planners and managers, the level of the sector's output and the technological characteristics of its production processes as embodied in its stock of plant and equipment are major influences on its need for energy.

Because of differences between planned and market economies, however, the relative importance of other influences on energy demand differs. Chronic supply problems in the Soviet system, coupled with weak incentives to minimize cost, tend to make availability and predictability of energy supplies much more important than relative prices. If supplies of one type of energy are subject to periodic interruption, consuming sectors may substitute, on a temporary or permanent basis, other types for which supplies are more stable.[8]

In market economies relative prices of energy inputs are important influences on demand. Energy-consuming sectors in the Soviet economy are more generally viewed as "quantity takers" in a system where central planners ration supplies than as "price takers" in a system where purchases of inputs change in response to price signals. Nevertheless, some recent evidence suggests that costs and prices of energy are becoming important considerations in determining Soviet energy demand as well as in modifying traditional planning methods.[9]

SUMMARY OF PROJECTION METHOD

The consumption projections in this paper are developed by first taking direct account of the most important influence on demand: levels of sectoral output as measured by contributions to gross national product (GNP). Initial estimates of trends in aggregate energy consumption are made by multiplying 1972 levels of consumption in each sector by indexes of growth in sector GNP and summing the products for all domestic users. The initial estimates are checked against annual observations for the period 1970–80.

A subsequent adjustment makes explicit provision for trends in interfuel substitution, which of course is affected by the interaction of the other influences. The adjusted estimates depend on data available for only three years: 1970, 1975, and 1980. At the cost of fewer observations, the substitution adjustment makes possible an important benefit. Through disaggregation, it permits separate treatment of conversion of fuels to electric power, where past trends in substitution can most easily be reversed. Finally, a trend adjustment is made to reflect indirectly the aggregate effects of other influences, such as substitution in processes other than conversion and changes in efficiency.

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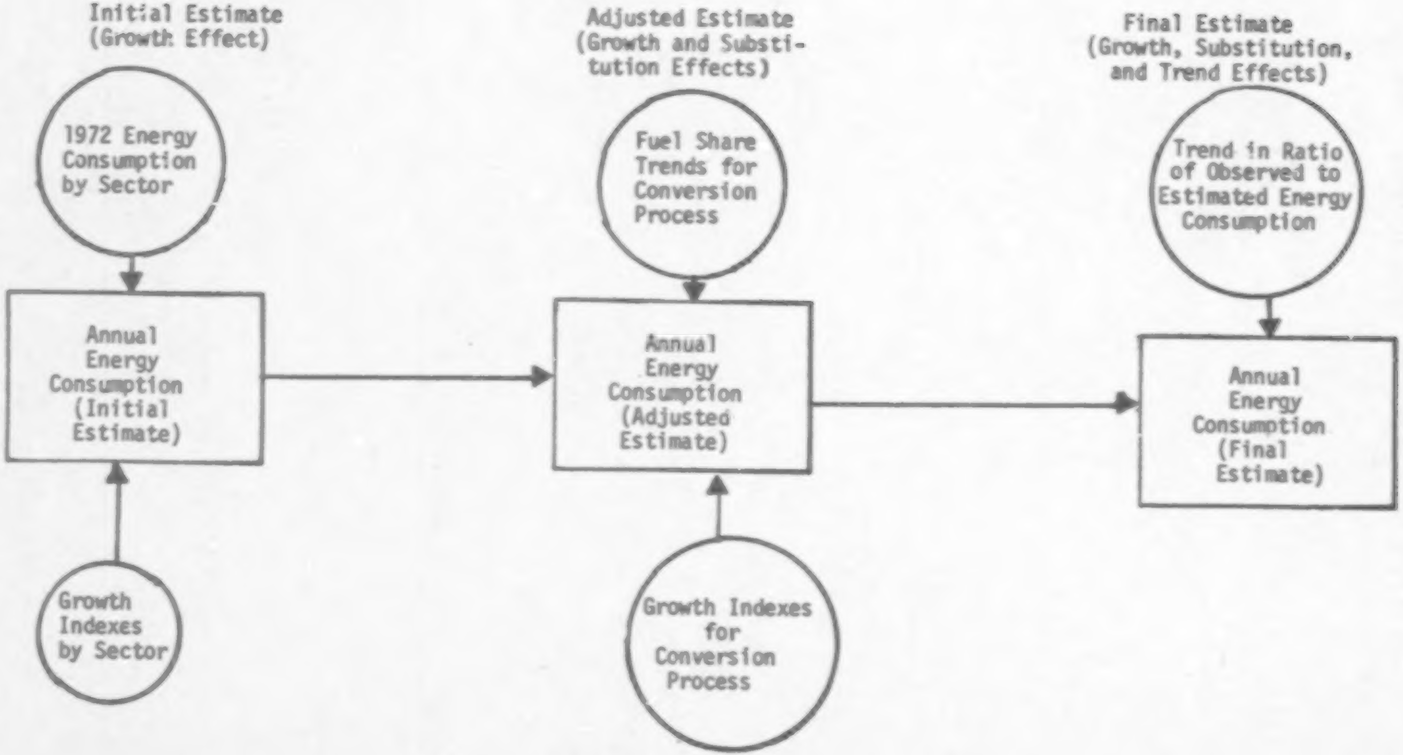
[8] For example, because of seasonal variations in gas production and consumption, boilers are often designed to use either gas if available or fuel oil otherwise.

[9] The role of costs and prices in Soviet energy planning is discussed in Judith Thornton, "The Soviet Response to Changing Fuel Cost and Availability: The Case of Electric Power" (final report to the National Council for Soviet and East European Research, May 1982, pp. 5–8). That paper also presents empirical evidence that long-run demand for fuel inputs in electric power generation responds quite strongly to price changes but short-run demand responds only weakly.

Other evidence in the paper just cited, however, contradicts the conventional view expressed above that availability of energy supplies is an important influence on demand. Although long-run demand for gas is found to respond to availability, other long- and short-run demands for fuel are not found to respond.

Figure 5

Schematic Diagram of Projection Method


Initial Estimate
(Growth Effect)
1972 Energy Consumption by Sector
Annual Energy Consumption (Initial Estimate)
Growth Indexes by Sector
Adjusted Estimate
(Growth and Substitution Effects)
Fuel Share Trends for Conversion Process
Annual Energy Consumption (Adjusted Estimate)
Growth Indexes for Conversion Process
Final Estimate
(Growth, Substitution, and Trend Effects)
Trend in Ratio of Observed to Estimated Energy Consumption
Annual Energy Consumption (Final Estimate)

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The principal features of the projection method are outlined below and illustrated in figure 5. To develop projections for 1985, the method is first tested by comparing its estimates with historical trends for 1970–80. The first step in testing the method is to compute initial estimates of energy consumption. Two sources of data are employed for these estimates: the 1972 data base on apparent consumption of energy [10] and time-series data on GNP by sector of origin.[11] It is assumed for this first step that both the ratio of total energy used to GNP in each consuming sector and the structure of each sector's consumption by type of energy are the same in all years as in 1972.[12] Consumption of each type of energy in a year other than 1972 is then estimated for each sector by multiplying the level of consumption in 1972 by an index of growth in sector GNP. Aggregate consumption of each type for the economy as a whole is found as the sum of consumption by all domestic users. Even for this first step, ratios of energy to GNP are not fixed for the economy as a whole. Instead, the ratios change over time in response to changes in the structure of GNP produced by each sector.

The initial estimates can be compared with annual observations of aggregate consumption for the historical years 1970–80.[13] The most striking result of the comparison is that the initial estimates fail to reflect the substitution that occurred during the period.[14] Because of changes in both supply and demand influences on energy consumption, there was a steady pattern of substitution away from coal toward oil products, gas, and electric power (see figure 6). Therefore, initial estimates of coal consumption are lower than actual levels before 1972 and higher afterwards. The reverse relationship is observed for oil products, gas, and electric power. For all types of energy, errors grow steadily larger for years farther from 1972.

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[10] In the absence of efficiency changes that are differentiated by process, projections of apparent, gross, and net consumption give equivalent results. Although changes have undoubtedly occurred, they are ignored here because, as stated below, substitution trends are dominant.

[11] The measures of GNP are obtained from Central Intelligence Agency (CIA) GNP accounts by sector of origin. They are valued at constant 1970 prices based on adjusted factor cost. The sectors of origin are the same as the sectors listed in figure 2. See the paper by John Pitzer in Joint Economic Committee, Congress of the United States, "Gross National Product of the USSR, 1950–80" (December 1982).

[12] This assumption is equivalent to assuming that ratios of energy input to GNP remain fixed for each type of energy. It is similar to the assumption of fixed input coefficients commonly made in IO analysis, but two minor differences should be noted. First, the standard IO assumption is that input coefficients are fixed relative to gross output, while the present assumption is that the coefficients are fixed relative to GNP, or value added. Because the standard approach also assumes that value added is fixed relative to gross output, however, it differs from the present approach only if that assumption does not hold. Second, the present assumption applies to both inputs for intermediate sectors and purchases by final users, while the standard assumption applies only to the former. This rigidity is relaxed, however, in subsequent steps of the projection method.

[13] It should be noted that the apparent consumption figures used in this paper are likely to differ slightly from similar figures reported elsewhere. The coverage of products for the major types of energy in the data base differs from the coverage for similar types reported in Soviet statistical yearbooks. To make the coverage here match that of the data base, indexes for other years are combined with 1972 weights from the data base. For each major type of energy, the observation of total apparent consumption is found as a weighted average of indexes of production, exports, and imports, where corresponding measures from the 1972 data base serve as weights. Production indexes are obtained from CIA accounts for industry. See the paper by Ray Converse in Joint Economic Committee, Congress of the United States, "An Index of Industrial Production in the USSR (December 1982). Indexes of exports and imports are obtained from data compiled by the Bureau of Mines of the Department of the Interior and published each year in the "Mining Annual Review."

[14] At the same time, the initial estimates can be compared with alternative estimates made by assuming that simple energy-GNP ratios—without disaggregation by consuming sector—remain constant over time. The comparisons demonstrate that the breakdown of the data base by consuming sector improves the explanation of trends in aggregate energy consumption. For all major types of energy except coal, the present initial estimates match observations better than the alternative estimates.

The exception in the case of coal has a reasonable explanation. Because coal consumption has fallen relative to GNP, disaggregation should yield better results than the simple approach if sectors that use large shares of coal output have on balance grown more slowly than average. One of the major users of coal, however, is the electric power sector, which has grown consistently faster than average.

FIGURE 6A
COMPARISON OF OBSERVED ENERGY CONSUMPTION
WITH INITIAL AND ADJUSTED ESTIMATES

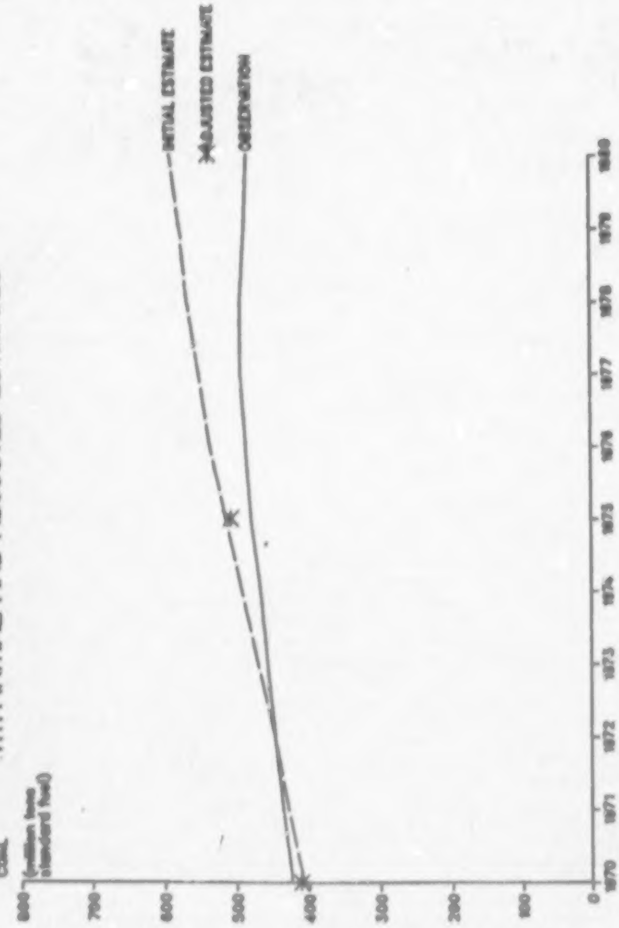

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FIGURE 6B
COMPARISON OF OBSERVED ENERGY CONSUMPTION
WITH INITIAL AND ADJUSTED ESTIMATES

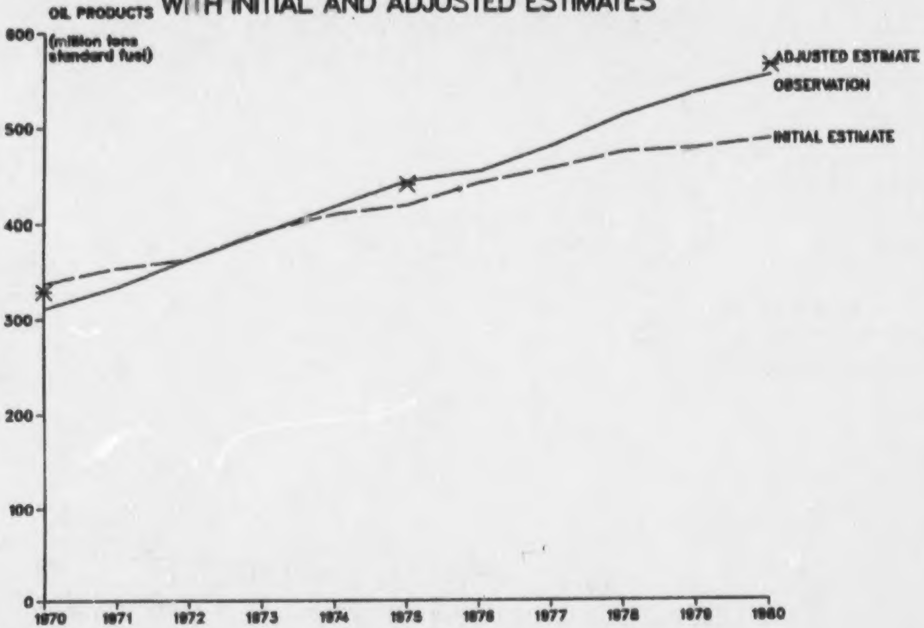


FIGURE 6C
COMPARISON OF OBSERVED ENERGY CONSUMPTION
WITH INITIAL AND ADJUSTED ESTIMATES

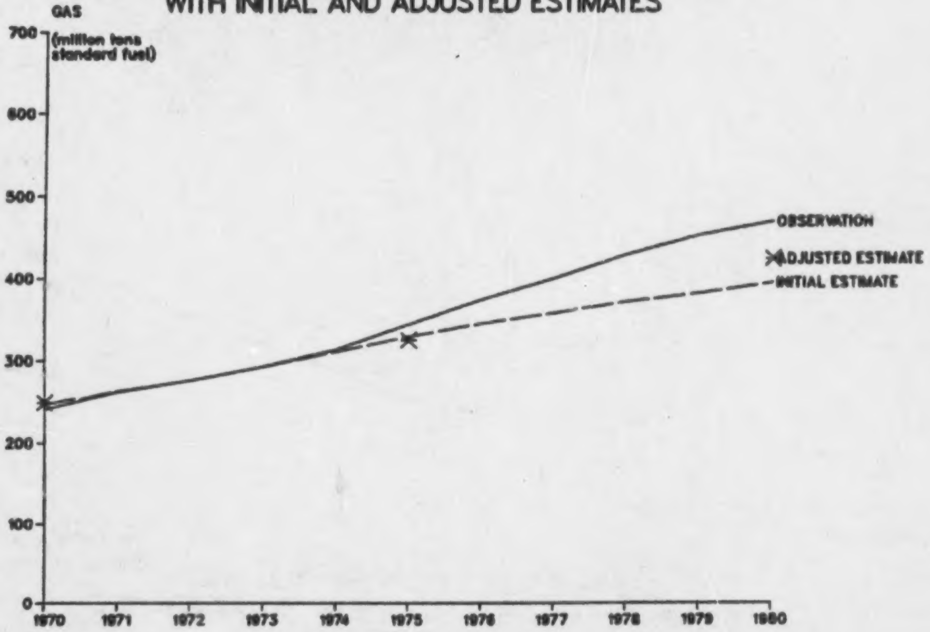
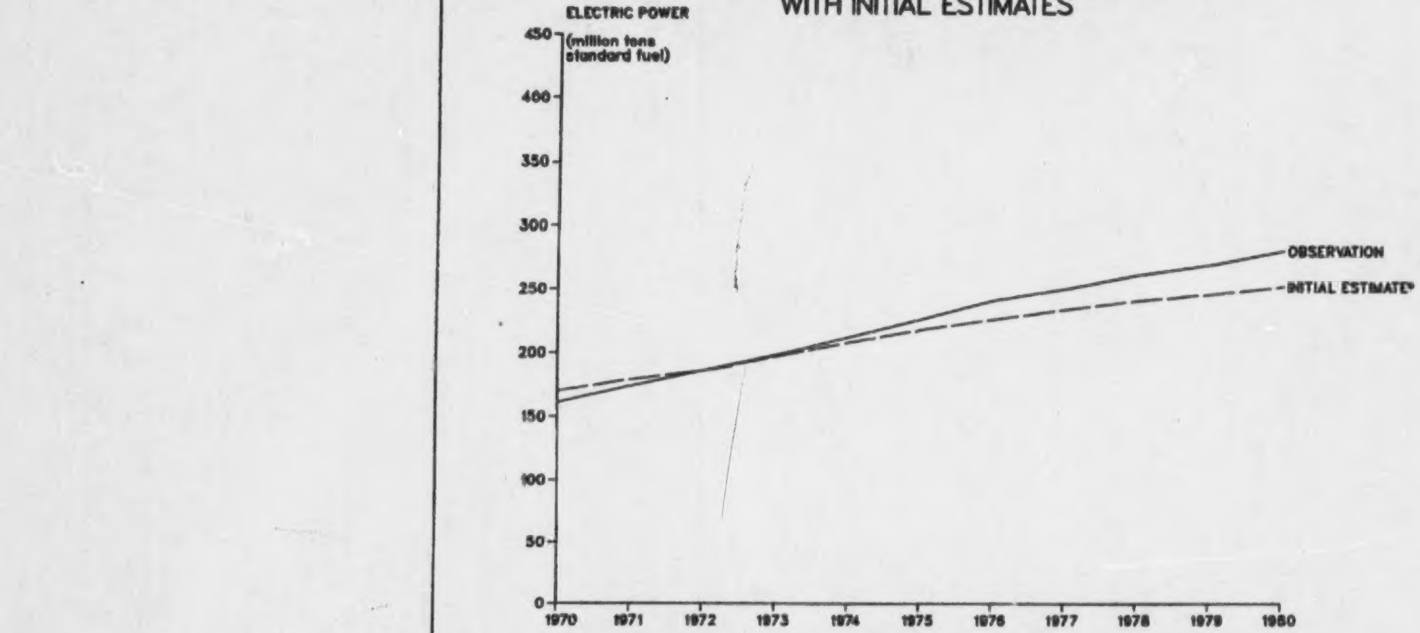


FIGURE 6D
COMPARISON OF OBSERVED ENERGY CONSUMPTION WITH INITIAL ESTIMATES



*NO SUBSTITUTION ADJUSTMENT IS MADE FOR ELECTRIC POWER BECAUSE THE NECESSARY DATA ARE NOT READILY AVAILABLE.

Because substitution is the dominant source of discrepancies between the initial estimates and historical observations, the estimates are adjusted to make partial corrections for trends in substitution.[15] The initial estimates of energy consumption require only part of the detail of the 1972 data base—the breakdown by type of energy and consuming sector. For the substitution adjustment, the further breakdown by energy-using process within each sector becomes important.[16] Substitution possibilities depend primarily on the technological characteristics of the processes in which energy is used. Of the five processes identified in the data base, conversion of fuels to electricity and heat is the one in which substitution can be implemented most readily at relatively low cost. Information about substitution in this process is also readily available.

The principal substitution adjustment, then, is applied to consumption of fuels in the conversion process in all sectors where electricity and heat are generated. A related adjustment is also made for substitution among fuels that provide process heat for private consumption.[17] For the conversion process in each sector, adjusted consumption of each type of fuel in another year is estimated by multiplying the 1972 level of consumption by two indexes.[18] The first is an index of the trend in the share of that fuel type in total consumption of fuel for conversion. The second is an index of growth in conversion activity in the sector.[19] Consumption of energy in all other processes is not affected by this adjustment. As in the first step, aggregate consumption for the economy as a whole is found as the sum of consumption by all domestic users in all processes.

The importance of the substitution adjustment can be tested for the three historical years for which it is made. As illustrated in figure 6, the substitution adjustment typically reduces the discrepancies between observed and estimated energy consumption.[20]

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[15] The initial estimates ignore changes in efficiency as well as substitution. Because efficiency has been increasing, the result of ignoring it should be to overstate the initial estimates in comparison with observations after 1972. It can therefore be concluded that the effects of changes in substitution dominate the effects of changes in efficiency for oil products, gas, and electric power—where the initial estimates turn out to be understated. For coal it can only be concluded that some combination of changes in efficiency and substitution results in overstatement of the initial estimates.

[16] The breakdown into detailed types of energy also becomes important, primarily for oil products. As stated in the text below, the adjustment applies only to fuels used for conversion. Therefore, it is made only for heavy products such as residual fuel oil, not for light products such as motor gasoline.

[17] Consumption of gas and electricity in household stoves is an example.

[18] It should be reemphasized that these indexes are available only for 1970, 1975, and 1980.

[19] The index of growth in conversion activity replaces an index of growth in sector GNP on the grounds that energy used in conversion is not as closely tied to sector GNP as energy used in other processes. In addition to the data used for the initial estimates, the substitution adjustment thus requires information about trends in the shares of individual types of fuel used for conversion and growth in conversion of fuels to electricity and heat. Growth in production of electricity and heat is used to approximate growth in conversion activity. Although the same share trends are applied to consumption for conversion in all sectors, separate production trends are applied to consumption for centralized conversion in the power sector and decentralized conversion in all other sectors. The additional data are taken from Soviet publications, primarily by authors associated with the Ministry of Energy and Electrification.

In the special case of process heat in private consumption, adjusted consumption of each type of fuel in another year is estimated by multiplying the 1972 level of consumption by an index of the trend in the share of that type in total fuel consumption for the sector and process and by an index of growth in sector GNP, not electricity and heat production.

[20] The adjustments for gas in 1970 and 1975 lead to somewhat worse consumption estimates in those years. This result reflects a slower increase in use of gas for conversion than for other

Continued

More important, the adjustment permits estimates for 1985 to treat substitution separately in the conversion process, where past substitution trends can most easily be reversed in the future. Soviet plans to hold down demand for oil products in this process make it especially desirable to take reversibility into account.

The substitution adjustment is only partially successful in reducing the discrepancies between observations of apparent consumption and initial estimates during the historical period. When the projection method is extended to the future, therefore, a trend adjustment is made to account for the remaining discrepancies. These discrepancies reflect the combined effects of changes in substitution and efficiency not incorporated in the substitution adjustment. Because the trend adjustment excludes the reversible changes already taken into account by the substitution adjustment, it should result in more reliable projections than an adjustment for the discrepancies between actual observations and initial estimates.

It is assumed here that the discrepancies remaining after the substitution adjustment will follow the same trend from 1980 to 1985 as from 1975 to 1980. The final estimate of aggregate apparent consumption of each type of energy in 1985 is then obtained by multiplying the 1985 estimate adjusted for substitution by an extrapolated ratio of observed consumption to that adjusted estimate.[21]

VI. ESTIMATES OF FUTURE SOVIET ENERGY BALANCES

Energy balances for historical periods are of course characterized by ex post equality of supply and demand. Thus apparent consumption can be measured either from the supply side as production minus net exports or from the demand side as the sum of all uses by domestic consuming sectors. When energy balances are estimated for the future, however, the possibility of ex ante inequality between supply and demand becomes important.

To examine the likely state of future Soviet energy balances, estimates of Soviet domestic energy consumption can be compared in two ways with projections of supplies available to the domestic economy. First, the consistency of the FYP can be tested by comparing production plans adjusted for net exports with consumption estimates based on plans for growth of the consuming sectors and for interfuel substitution in conversion to electric power. Second, the effects of projected differences between plan and performance on both supply and demand can be assessed.

Consumption estimates for 1985 are made by extending the time-series data required for the projection method with information from the 1981–85 plan. Indexes of planned GNP growth are available for the consuming sectors, as are indexes of planned fuel shares in conversion to power and planned growth of conversion activi-

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processes during the early 1970s. Seasonal variations in gas production probably made gas a more attractive substitute for other fuels in uses where seasonal variations in consumption are smaller than in conversion and more similar in timing to variations in production.

[21] No trend adjustment is made for oil products because the substitution adjustment in 1980 results in a slight overcorrection, rather than a partial correction, of the discrepancy between the observation and the initial estimate.

ty.[22] Trends in shares of fuels used for process heat in private consumption, however, are extrapolated on a judgmental basis.

The availability of plan information, it should be emphasized, makes it possible for trends in the projection period to differ from their counterparts over the historical period. Although the effect of shifts in trends in GNP indexes should not be ignored, changes in trends in shares of fuels used for conversion to power exert a crucial influence on future patterns of Soviet energy consumption.

TEST OF CONSISTENCY OF THE ELEVENTH FYP

Table 2 shows the steps in the consumption estimates developed for 1985.[23] As explained earlier, initial estimates reflect the effects of overall growth and changes in mix of GNP because ratios of energy consumption to sector GNP are held constant. Substitution adjustments incorporate the effects of interfuel substitution in conversion to power, where substitution can be implemented most readily at low cost, and trend adjustments take into account the combined effects of other changes in substitution and efficiency.

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[22] Indexes of planned GNP growth are obtained by combining indexes taken from official Soviet production plans with weights taken from the historical GNP accounts by sector of origin. In the absence of published information from official plans, indexes of planned GNP growth are obtained by extrapolation.

[23] Although the consumption estimates are built up from a highly disaggregated level, only the aggregate results are presented here.

Table 2

USSR: Estimates of Domestic Energy Consumption under Eleventh FYP Conditions, 1985

	Actual 1980	Estimated consumption			Ratio of 1985 estimated to 1980 actual
		Initial estimate	With substitution adjustment	With substitution and trend adjustments	
	(million tons standard fuel)				
Coal	483	695	649	557	1.15
Oil products*	552	598	604	604**	1.09
Gas	469	487	603	695	1.48
Electric power***	280	308	****	368	1.31

Notes:

* The term "oil products" should be understood to exclude miscellaneous non-fuel products, such as asphalt, that cannot be measured in terms of heat equivalents.

** No trend adjustment is made for oil products because the substitution adjustment in 1960 slightly overcorrected for the discrepancy between observed consumption and the initial estimate.

*** The term "electric power" should be understood to include heat in the form of steam and hot water as well as electricity.

**** No substitution adjustment is made for electric power because the necessary data are not readily available.

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Coal and gas provide mirror images in all three steps of the estimation process. The initial estimates of 1985 consumption show a sharp rise for coal and a slight increase for gas. When they are adjusted for the effects of planned interfuel substitution in conversion to power (a reduction of 7 percent in the initial estimate for coal and a rise of 24 percent for gas), and then for the effects of other changes in substitution and efficiency (down another 13 percent for coal and up another 19 percent for gas), the outlook for coal and gas consumption in 1985 changes dramatically. Between 1980 and 1985 the final projected increase in consumption turns out to be a relatively modest 15 percent for coal and a large 48 percent for gas under conditions of the Eleventh FYP.

The substitution adjustment increases the initial estimate of consumption of oil products in 1985 by only one percent. As can be seen from figure 6, this negligible change contrasts with larger increases that resulted from the substitution adjustments in 1975 and 1980 (5 percent and 16 percent, respectively). The contrast reflects Soviet plans to reverse the substantial increase in the share of oil products in total fuel consumption for conversion to power that occured during the 1970s to about the same share as in 1972. No trend adjustment is made for oil products because the substitution adjustment in 1980 slightly overcorrected for the discrepancy between observed consumption and the initial estimate. The projected increase in consumption of oil products between 1980 and 1985 is only 9 percent under the current plan, slower than for any other major type of energy.

Although no substitution adjustment is made for electric power, the trend adjustment increases the initial estimate by 20 percent. It would of course be desirable to make a separate substitution adjustment, but the necessary data are not readily available. Consumption of electric power is projected to increase by a relatively rapid 31 percent between 1980 and 1985.

Projections of energy supplies available to the domestic economy in 1985 are obtained by excluding net exports at assumed levels from planned energy production under the Eleventh FYP. Because these levels attempt to reflect minimum commitments to foreign purchasers, they should also reflect maximum availabilities for domestic consumption. The assumptions are conservative in the sense that they seek to avoid biasing the projections toward shortage. Because energy trade is not included in published information about the FYP, it is projected judgmentally on the basis of recent trends. Gas exports, however, are projected by increasing the current level to include estimates of deliveries resulting from contracts associated with the new export pipeline to Western Europe.[24]

Figure 7 illustrates historical trends in production, net exports, and apparent consumption of the major types of energy. It also shows the present projections of domestic consumption and availability under the plan in 1985.

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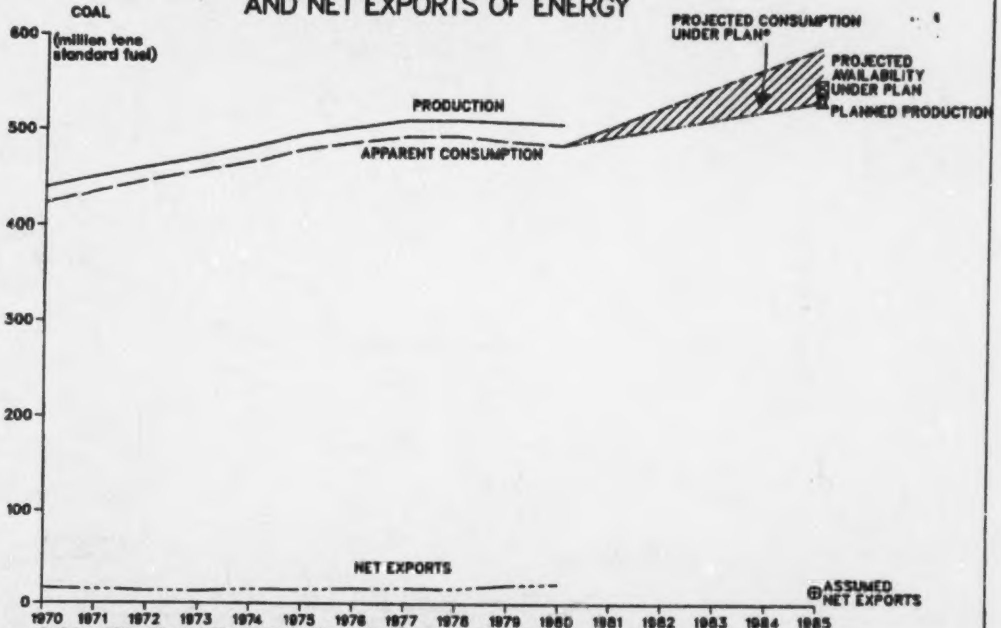
[24] Exports of coal and oil products increased by less than 10 percent between 1975 and 1980, while imports of both decreased. Exports of electric power increased rapidly but remained less than one percent of production. For these three types of energy, requirements for net exports in 1985 are conservatively assumed to equal the 1975 levels.

Exports of gas in 1985 are projected by adding conservative estimates of deliveries to be made under contracts already signed or about to be signed in connection with the new pipeline to the level of 1980-81. Gas imports are assumed constant at the 1980 level.

FIGURE 7A
TRENDS IN PRODUCTION, APPARENT CONSUMPTION AND NET EXPORTS OF ENERGY



*THE SHADED AREA IS DEFINED BY THE POINT ESTIMATE OF CONSUMPTION IN 1985 PLUS OR MINUS A 5 PERCENT ERROR. INTERMEDIATE YEARS BETWEEN 1980 AND 1985 ARE SHOWN ALONG STRAIGHT LINES CONNECTING APPARENT CONSUMPTION IN 1980 WITH THE LIMITS OF THE ESTIMATE FOR 1985.

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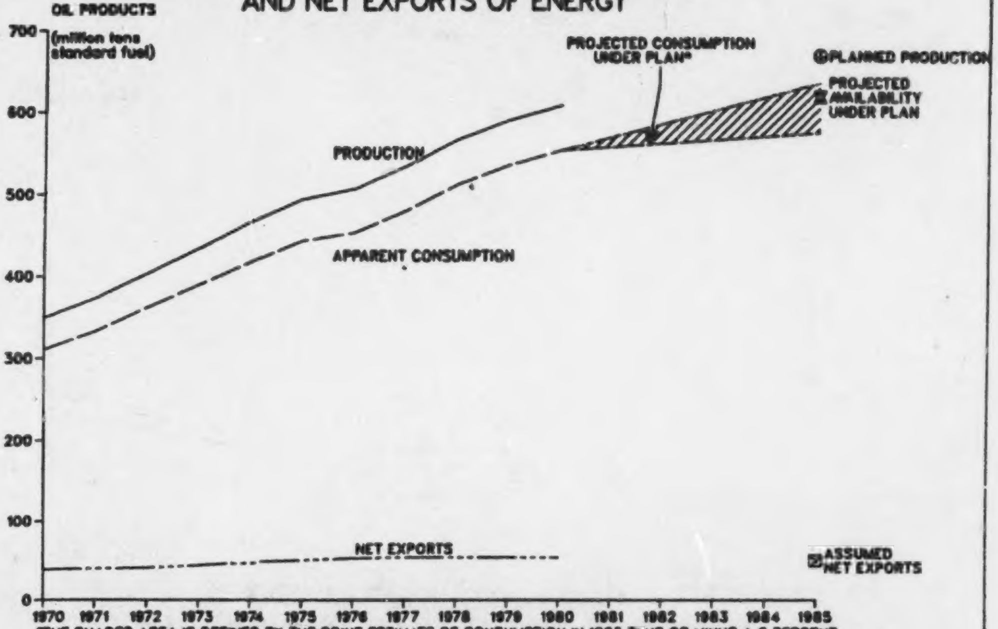
FIGURE 7B
TRENDS IN PRODUCTION, APPARENT CONSUMPTION AND NET EXPORTS OF ENERGY



*THE SHADED AREA IS DEFINED BY THE POINT ESTIMATE OF CONSUMPTION IN 1985 PLUS OR MINUS A 5 PERCENT ERROR. INTERMEDIATE YEARS BETWEEN 1980 AND 1985 ARE SHOWN ALONG STRAIGHT LINES CONNECTING APPARENT CONSUMPTION IN 1980 WITH THE LIMITS OF THE ESTIMATE FOR 1985.

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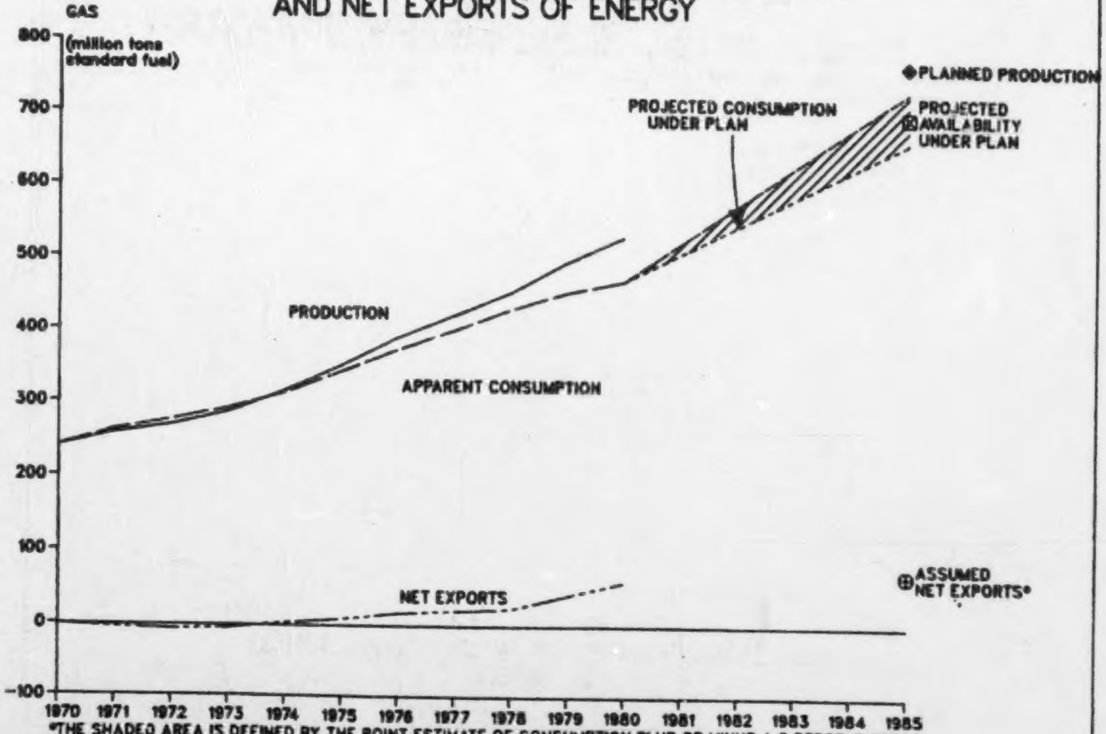
FIGURE 7C
TRENDS IN PRODUCTION, APPARENT CONSUMPTION AND NET EXPORTS OF ENERGY



*THE SHADED AREA IS DEFINED BY THE POINT ESTIMATE OF CONSUMPTION PLUS OR MINUS A 5 PERCENT ERROR. INTERMEDIATE YEARS BETWEEN 1980 AND 1985 ARE SHOWN ALONG STRAIGHT LINES CONNECTING APPARENT CONSUMPTION IN 1980 WITH THE LIMITS OF THE ESTIMATE FOR 1985.

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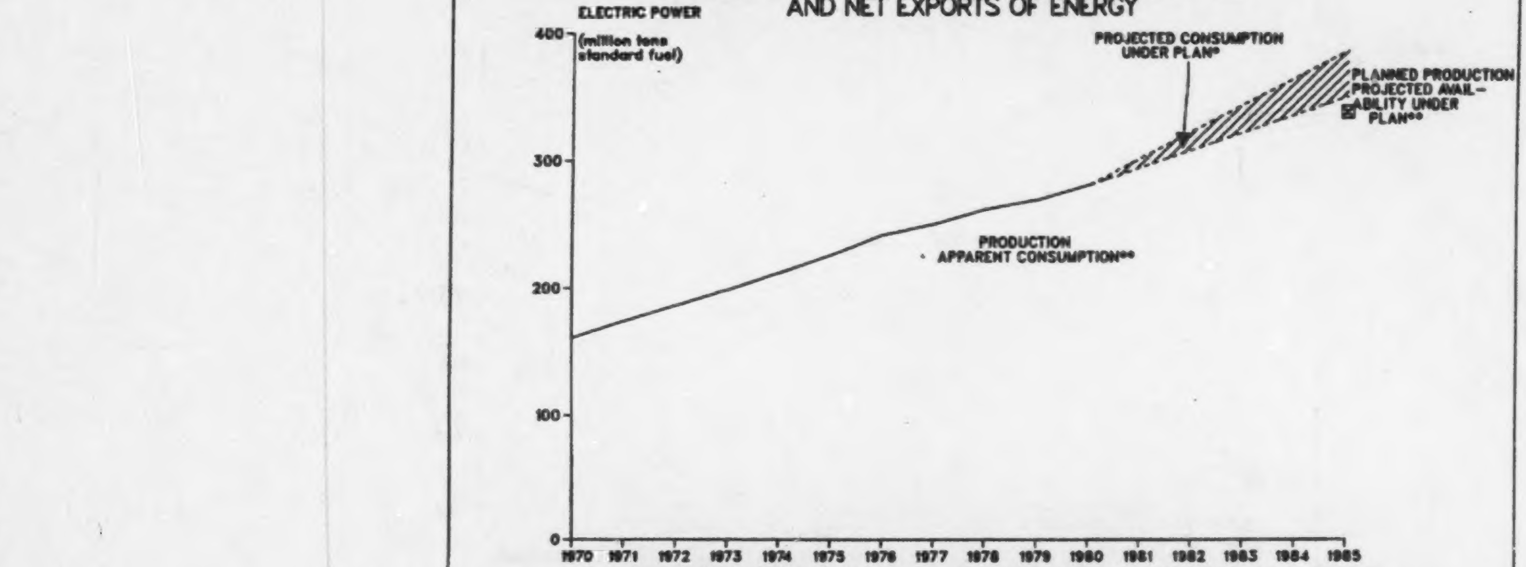
FIGURE 7D
TRENDS IN PRODUCTION, APPARENT CONSUMPTION AND NET EXPORTS OF ENERGY



*THE SHADED AREA IS DEFINED BY THE POINT ESTIMATE OF CONSUMPTION IN 1985 PLUS OR MINUS A 5 PERCENT ERROR. INTERMEDIATE YEARS BETWEEN 1980 AND 1985 ARE SHOWN ALONG STRAIGHT LINES CONNECTING APPARENT CONSUMPTION IN 1980 WITH THE LIMITS OF THE ESTIMATE FOR 1985.

**BECAUSE NET EXPORTS ARE LESS THAN 1 PERCENT OF PRODUCTION IN ALL YEARS PRODUCTION CANNOT BE DISTINGUISHED FROM APPARENT CONSUMPTION IN THIS FIGURE.

Table 3 summarizes the results of testing the consistency of the Eleventh FYP with respect to energy balances. It is reasonable to associate an uncertainty around plus or minus 5 percent with the consumption projections. Given this uncertainty, projections of domestic energy consumption in 1985 are essentially consistent with planned energy supplies for the three major types of fuel, but not for electric power. Demand is slightly greater than supply for coal and slightly less than supply for oil products and gas, but all three differences are less than 5 percent of supply. For electric power, however, demand exceeds supply by 9 percent, an indication of potential domestic shortages.

Table 3

USSR: Comparison of Projected Domestic Energy Consumption
and Projected Availability of Energy under Plan, 1985

Type of energy	Projected consumption under plan	Projected availability under plan			Consumption as percent of availability
		Planned production	Assumed net exports*	Projected availability	
	(million tons standard fuel)				
Coal	557	546	15	531	105
Oil products**	604	668	50	618	98
Gas	695	766	70	696	100
Electric power***	368	340	2	338	109

Notes:

* Exports of coal and oil products increased by less than 10 percent between 1975 and 1980, while imports of both decreased. Exports of electric power increased rapidly but remained less than one percent of production. For these three types of energy requirements for net exports in 1985 are conservatively assumed to equal the 1975 levels.

Exports of gas in 1985 are projected by adding conservative estimates of deliveries to be made under contracts already signed or about to be signed in connection with the new pipeline to the level of 1980-81. Gas imports are assumed constant at the 1980 level.

** The term "oil products" should be understood to exclude miscellaneous non-fuel products, such as asphalt, that cannot be measured in terms of heat equivalents.

*** The term "electric power" should be understood to include heat in the form of steam and hot water as well as electricity.

Although the entire impact of electric power shortages at mid-decade could be absorbed by domestic final users, this would require a large cutback in their consumption. The 1972 data base shows final users consuming more than 30 percent of power production, and the available evidence on trends indicates that the share of final users has increased since then. If a 9 percent shortage were to be borne only by final users, however, almost a 30 percent cutback in their consumption would be required. Therefore, some impact on consumption by producing sectors would be likely unless shortages could be avoided in ways discussed below.

EFFECTS OF DIFFERENCES BETWEEN PLAN AND PERFORMANCE

The second step in comparing projections of domestic consumption and planned supplies of energy is to assess the effects of projected differences between plan and performance. Table 4 shows that plans for energy production in recent FYP periods have usually remained unfulfilled. The only exceptions are above-plan production of oil in 1970 and coal in 1975, and gas production equal to plan in 1980.[25]

TABLE 4.—USSR: COMPARISON OF 5-YEAR PLANS AND RESULTS FOR PRODUCTION OF ENERGY

	1970		1975		1980		1985
	Plan	Result	Plan	Result	Plan	Result	Plan
Coal (million metric tons)	([1])	624.1	694.9	701.3	805	716.4	775
Crude oil (million metric tons)	350	353.0	505	490.8	640	603.2	630
Gas (billion cubic meters)	214	197.9	320	289.3	435	435.2	630
Electricity (billion kilowatt hours)	801	740.9	1,065	1,038.6	1,380	1,295.0	1,555

[1] Less than 665.

Sources:

Plan figures: FYP targets are typically revised after the first official directives are issued. All plan figures above are taken from the first revision of the FYP for the year specified:

1970: Pravda, 11 Oct. 1967.
1975: "Gosudarstvennyy pyatiletniy plan razviliya narodnogo khozyaystva SSSR na 1971–1975 gody" (Moscow, Politizdat, 1972, pp. 98–99).
1980: Pravda, 28 Oct. 1976.
1985: Pravda, 17 Nov. 1981.
Result figures: "Narodnoye khozyaystvo SSSR v 1980 godu" (Moscow, Finansy i statistika, 1981, pp. 154–157).

Two kinds of differences between plan and performance can be expected to affect the consumption estimates. First, plans for growth in the energy-consuming sectors can turn out to be either over- or understated. The net effect of these divergences from plan will depend not only on the frequency of over or understatement but also on the distribution of divergences among consumers with high and low energy intensities of production. If plans are overstated on balance and if divergences are distributed uniformly, the net effect will be to overstate the consumption estimates.

Second, plans for interfuel substitution in conversion to power will in general differ from results. If the planned extent of substitution is not achieved, the consumption estimates will be overstated for those fuels for which increases in shares are planned—coal and gas—and understated for those for which decreases are planned—oil products.[26]

Although it is difficult to judge the extent of interfuel substitution likely to be realized in 1985, it is unlikely that the planned extent will be achieved. Table 5 shows planned and realized shares of several types of fuel in total fuel consumption for conversion to power in 1975 and 1980, along with planned shares for 1985. It is evident that in the late 1970s the Soviets failed to stabilize the share of oil products in fuel consumption for conversion to power. The stagnation of coal production was responsible in large part. Although the 1981–85 plan calls for a sizable cut in the share of oil products, the cut would have to be achieved through an increase in the coal share and a sharp rise in the gas share. Given the associated problems of increasing gas and coal production, commissioning new power stations, modifying old power stations for gas and coal consumption, and expanding the gas distribution system, it is not likely that planned substitution goals will be achieved.

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[25] It must be pointed out that the oil production figures in table 4 are not strictly comparable with those in table 3. The difference is that the former apply to crude oil while the latter apply to refined products.

[26] Because no substitution adjustment is made to estimates of electric power consumption, the second kind of difference between plan and performance does not affect them.

TABLE 5.—USSR: SHARES OF TYPES OF FUEL IN TOTAL FUEL CONSUMPTION FOR CONVERSION TO POWER

[In percent]

Type of fuel	1975[1]		1980[2]		1985[2]
	Planned	Realized	Planned	Realized	Planned
Coal	42.6	41.3	45.8	37.3	39.6
Oil products	25.1	28.8	28.0	35.7	25.9
Gas	26.8	25.7	22.0	24.2	31.5
Peat	3.5	2.0	2.6	1.0	1.5
Oil shales	1.6	1.7	1.6	1.8	1.5
Other	.4	.5			
Sum	100.0	100.0	100.0	100.0	100.0

[1] Shares apply to fuel consumption by all electric power stations.

[2] Shares apply to fuel consumption by electric power stations subordinate to Ministry of Energy and Electrification.

Sources:

1975 Planned: A.S. Pavlenko and A.M. Nekrasov, "Energetika SSSR v 1971–1975 godakh" (Moscow, Energiya, 1972, p. 171).

1975 Realized and 1980 Planned: A.M. Nekrasov and A.G. Pervukhin, "Energetika SSSR v 1976–1980 godakh" (Moscow, Energiya, 1977, p. 151).

1980 Realized and 1985 Planned: A.M. Nekrasov and A.A. Troitskiy, "Energetika SSSR v 1981–1985 godakh" (Moscow, Energoizdat, 1981, p. 230).

It is difficult to make independent estimates of shortfalls from plan in energy production and economic growth. Depending on the type of energy, production shortfalls of about 5 to 10 percent seem likely in 1985. This judgment is based on relationships between plan and performance during the Tenth FYP (1976–80) and on subsequent trends. In the cases of oil and coal, the shortfall estimates are also based on subjective evaluation of the increasing difficulties of getting access to exploitable reserves by mid-decade.

Recent trends in overall economic growth suggest that shortfalls on the demand side are also likely. On the basis of the plan-performance record during the 1976–80 plan period, an average shortfall of about 10 percent with a rough deviation of plus or minus 5 percent seems reasonable. Alternative assumptions about whether the deviations are concentrated in sectors with high or low energy intensities of production can then be used to calculate a range of possible effects on energy consumption. A "worst-shortage" situation could arise if the largest growth shortfalls of about 15 percent were to occur in sectors with low energy intensities and the smallest shortfalls of about 5 percent in sectors with high energy intensities.

Alternative assumptions can also be used to assess the effects of failure to achieve plans for interfuel substitution. A "worst-imbalance" situation could arise if substitution of oil products for coal and gas were maintained as it evolved through 1980, not reversed as planned. The resulting shortage of oil products by 1985 would then be accompanied by a surplus of gas.

The worst-case assumptions about the effects on energy demand of failure to meet plans for growth and substitution can be combined to assess a maximum net impact on energy balances for 1985. The impact on the rough balance for coal would be negligible. The outlook for oil products would worsen from balance to a shortage of about 10 to 15 percent, while the outlook for gas would improve from balance to a surplus of about 10 to 15 percent. The projected imbalance for electric power would be reduced but probably not eliminated.

Soviet planners could respond to about a 10- to 15-percent shortage of oil products by letting inventories and exports absorb the impact. According to the base-year data for 1972, net additions to inventories and net exports each amounted to about 10 percent of production of oil products. Although trends in inventory change are not available, stocks would probably remain adequate to absorb part of the impact of a shortage in 1985. This remedy would be only temporary, however, since sizable stock drawdowns cannot be accomplished regularly and repeatedly. Net exports have been maintained at about the same share of production as in 1972, so that complete elimination of exports of oil products could in itself almost absorb the impact of a 10- to 15-percent oil products shortage in 1985. This remedy, however, would entail a reduction of foreign exchange earnings that might be unacceptable to the Soviets.[27] If cutbacks in final use of oil products—either exports or inventories—turned out to be a temporary or unacceptable solution, consumption by producing sectors would be affected and domestic economic performance would suffer.

The projected power imbalance in 1985 poses a different problem. If ratios of power consumption to economic activity were not to increase at recent rates but remain at current levels, demand for electric power could be held in balance with supply in 1985.

The effects on economic growth of such a break in past trends in power consumption could be limited only through increases in efficiency or through substitution of direct fuel use for power. Soviet planners, however, might find it more difficult to raise efficiency than to let final users bear the impact of shortages. Substitution of direct use of fuels for power would be an even less attractive remedy because it would tend to reduce the efficiency of the energy system as a whole. If surplus gas were available, however, this consideration would be less important.

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[27] Exports of refined products amounted to only about 25 percent of total oil exports (crude and products) in standard fuel terms in 1980. Refined exports sold for hard currency, however, were about 40 percent of total hard currency oil exports.

NEAR-TERM PROSPECTS FOR THE SOVIET NATURAL GAS INDUSTRY, AND THE IMPLICATIONS FOR EAST-WEST TRADE

By Ed. A. Hewett *

CONTENTS

Page

I. Introduction 391

II. Prospects for the Soviet gas industry in the 1980s 393

  A. The increasing importance of natural gas in Soviet production plans 393

  B. A brief overview of the history of the industry 394

  C. The natural gas plan for 1981-85 396

  D. Major challenges in the 1981-85 gas plan 397

  E. The feasibility of the 1985 gas output plan 404

  F. Urengoi No. 6 405

  G. A prediction for 1985 406

III. Implications of developments in the Soviet natural gas industry for East-West trade and cooperation 408

IV. Implications for energy equipment imports from the West of developments in the Soviet natural gas industry 408

V. Implications of development of Soviet natural gas for Soviet energy exports, and for Western Europe's energy imports from the USSR 410

VI. Changing West European dependence on Soviet energy exports 412

TABLE

1. Natural gas production, total and by region, 1950-80 395

I. INTRODUCTION

The Soviet Union is in the midst of an ambitious attempt to increase by half its output of natural gas between 1981 and 1985, in the Eleventh Five Year Plan (FYPXI). The planned jump in natural gas output from 435 billion cubic meters (bcm) in 1980 to 630 bcm in 1985 accounts for 65 percent of the total planned increments to energy supplies during 1981-85; and in fact it will probably be 100 percent of the increment to supplies actually realized.[1] What happens to this natural gas plan is therefore the major determinant of what happens to Soviet energy supplies in the early 1980s. And those supplies will, in turn, have a major influence on Soviet hard currency earnings, hence their imports of grain, intermediate products, and new technology. The natural gas plan is, therefore, one of the lynchpins of FYPXI.

The feasibility of natural gas plans has little to do with gas reserves; the Soviets have over one-third of all the proved natural gas reserves in the world. The Urengoi field in northwest Siberia, which is to be the major source of increments to natural gas output

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[1] Hewett, 1982.

during FYPXI, has in an area only slightly smaller than the state of Delaware at least 6 trillion cubic meters of reserves, enough to sustain 24 years of output at the 250 bcm output level planned for 1985 (1980 output was only 50 bcm).

The feasibility of gas plans rests on Soviet capabilities to expand the gas preparation and pipeline system with sufficient rapidity to move the planned increments to natural gas supplies from fields an average distance of some 3000 kilometers to industrial centers in the European USSR, or a distance of over 4500 kilometers to the USSR's western border for export. To achieve the increments to output and exports planned during 1981–85 the Soviets intend to commission on average one 56" pipeline every ten months, a task historically unprecedented in the USSR in terms of the capital, labor, and speed required. The Soviet government is now totally committed to this ambitious program, making it the largest and most visible symbol of FYPXI; the press is flooded with articles concerning every aspect of the projects; and reportedly the relevant ministries and the leadership receive detailed daily reports on the progress of pipeline construction.[2]

According to one's viewpoint it could be argued that the Soviet government's decisive commitment to natural gas for the 1980s is 1.) a natural and economically justifiable decision by planners in a country richly endowed with all energy resources, and particularly with natural gas or 2.) an act of desperation by an economic system incapable of exporting its manufactured goods, or of producing sufficient food, and therefore required to export its natural wealth in order to feed the population and avoid political difficulties. In this interpretation natural gas was chosen by elimination because it is the only energy carrier whose output can be expanded in the 1980s at a remotely reasonable cost.

In fact there seem to be elements of truth in both of these views. It is difficult to say with certainty that current Soviet investments in their natural gas distribution system would be profitable if all the inputs (labor, capital, and so on) were priced at world market prices, and compared to the stream of anticipated receipts from natural gas. But it is quite likely that in fact this is a profitable investment indeed, barring a collapse in the price of energy. On the other hand planners turned to natural gas only after difficulties in oil and coal output in the late 1970s forced them to increase the priority of the natural gas industry. In fact, careful planning and more attention to the economics of energy production might have pushed them into natural gas at an earlier stage. But they were acting more like central "probers" than central planners, and as a result the transition to natural gas commenced at a rather late date, for which they are now paying in the required breakneck speed of pipeline construction. Finally the switch to gas is certainly in part motivated by a need to sustain hard currency earnings to sustain imports at acceptable levels, an inability to produce manufactured goods in sufficient quantities to earn the hard currency, and therefore a necessity to rely on energy exports for that hard currency.[3]

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[2] "Velikaia stroika. . .," p. 2.

The United States and Western Europe became involved in a portion of Soviet plans to expand gas production through the various negotiations for the gas pipeline from Northwestern Siberia to Europe, variously called the Yamal or Yamburg line, and here referred to as "Urengoi No. 6."[4] The intention is to build the line relying heavily on western turbines, compressors, and pipe, and on western finance to provide loans, to be repaid as the gas is sold to Europe. Abstracting from political considerations, this was a sensible business deal which ran into opposition from the United States. Now the various deals involved seem to have been, in all important respects, concluded over the objections of the United States, and the question is what the prospects are for Soviet gas exports, and for net Soviet hard currency earnings, in light of the agreements already concluded. That is the ultimate question for which this paper offers an answer. However, before turning to that issue it is necessary to consider the Soviet natural gas industry as a whole, its prospects, and how they are intertwined with those for Urengoi No. 6. It will also be necessary to touch upon prospects for total Soviet energy balances, although those are covered in more detail elsewhere.[5]

II. Prospects for the Soviet Gas Industry in the 1980s

A. THE INCREASING IMPORTANCE OF NATURAL GAS IN SOVIET PRODUCTION PLANS

In his speech to the 25th Party Congress in February 1981, Leonid Brezhnev clearly gave a very high priority to the development of natural gas production. In doing so, he continued a relatively recent, but accelerating, shift in Soviet planners' priorities away from coal, and even away from oil, towards natural gas. As recently as the mid-1970s, the official strategy of Soviet planners was to push the development of coal, saving oil and gas for high value, primarily nonfuel, uses. But problems in the coal industry appeared increasingly intractable and there was a marked change in strategy beginning in 1977–78, with a progressively higher priority being accorded oil and gas. A key Central Committee Meeting in December 1977 and Brezhenev's trip to Siberia in Spring 1978 signalled the importance that the highest levels of the party and government attached to the rapid and successful development of Siberia's oil and gas resources.[6]

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[3] It is, of course, not clear in this instance that if a different economic system were prevailing in the USSR, one more prone to rely on markets to decide on resource allocation, that a dramatically different trade pattern would emerge. It makes sense because of resource endowments that the United States, one of the industrially most advanced countries in the world, is a major producer and exporter of agricultural products. Similarly it might make sense for the USSR to be an exporter of energy in exchange for food under any economic system. But the fact remains that in spite of Soviet planners' efforts to expand manufactured goods exports and contain grain imports, they are almost compelled to import a great deal of grain in exchange primarily for energy.

[4] At an early stage in Soviet discussions with Western Europe (1979), the Soviets were discussing taking the natural gas from fields in the Yamal Peninsula (approximately 500 kilometers northwest of Urengoi), then later they began discussing taking gas from the Yamburg field, closer to Urengoi, but still several hundred kilometers north of it. They have subsequently decided that Urengoi can handle all of the demands in FYPXI, and are limiting their efforts to that field in order to economize on infrastructural investments. The name "Urengoi No. 6" is used to denote the fact that plans now call for five new domestic lines and a sixth, export, line.

[5] Hewett 1982.

It was also in 1978 that problems began to emerge in the oil industry. During that and the following year, it was increasingly clear to outside observers, and must have been clear to Soviet planners, that original plans to produce 620–640 million tons of oil in 1980 were unachievable. Coincident with the appearance of difficulties in the oil industry, estimated natural gas reserves—already enormous by world standards—continued to rise. Despite the unfavorable location of those reserves, planners have apparently concluded that they are less expensive to develop than oil. Thus, Leonid Brezhnev's statement at the party congress that "I consider rapid increases in the output of Siberian gas to be a political and economic matter of the first order." [7] While there is still evidence of considerable debate within the Soviet planning bureaucracy concerning the advisability of a heavy emphasis on gas, it seems likely that, in fact, the 1980s will be the "decade of gas" in the USSR and, therefore, also the "decade of Siberia".

B. A BRIEF OVERVIEW OF THE HISTORY OF THE INDUSTRY [8]

The natural gas industry developed rather late in the USSR compared to other countries with large natural gas reserves. The development of the richest deposits of natural gas found in West Siberia did not begin in earnest until a decade ago. Into the 1960s, Soviet planners had devoted the majority of their resources in the energy sector to coal, and then petroleum. It was in the 1960s, in the process of oil exploration in Siberia, that the Soviets became fully aware of the potential gas reserves in the region. In the space of five years four "supergiant" fields were discovered in Tiumen' Oblast in northwestern Siberia, in an area straddling the arctic circle: the Zapolyarnoye field in 1965 (reserves then estimated at 2 trillion cubic meters or 2 tcm), the Medvezh'e field in 1966 (1.5 tcm), the huge Urengoi field in 1966 (3.9 tcm), and the Yamburg field in 1969 (2.5 tcm). Subsequently, reserve estimates for these fields have generally risen even higher.

Table 1 summarizes the time path of output over the last three decades, and plans for 1985. Natural gas output in the early 1950s was miniscule, concentrated almost wholly in the European USSR, and in significant proportion (approximately one-third) associated gas. In the decade of the 1950s, Soviet planners made their first serious efforts to develop dry gas production focusing on fields in the Ukraine and North Caucasus. As a consequence, by 1960, natural gas output was almost eight times higher than it had been a decade earlier, and of the 45.3 bcm, only 7.7 was associated gas. At this date, the large West Siberian fields were still unknown, and gas production was essentially confined to the southern European part of the USSR. Simultaneous with the large Siberian discoveries production in the North Caucasus fields peaked in the late 1960s (at a little under 50 bcm) and output increments began to fall off in the major Ukranian fields. As a consequence Soviet planners turned to the Siberian fields, the first one being Medvezh'e (along with some smaller fields), followed now by Urengoi.[9]

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[6] See Thane Gustafson's contribution to this volume for a discussion of the evolution of energy policy in the 1970s.

[7] Brezhnev 1981, p. 30.

[8] See Stern 1980 for a discussion of the early history of the Soviet gas industry.

TABLE 1.—NATURAL GAS PRODUCTION, TOTAL AND BY REGION, 1950–85

[Billion m³]

	Total	Of which:		
		European USSR and Urals	W. Siberia	Other
1950	5.76	5.56	0	0.20
1955	8.98	8.52	0	.46
1960	45.30	44.20	0	1.10
1965	128.00	109.00	.60	18.40
1970	198.00	139.00	9.30	49.70
1975	289.00	154.00	35.70	99.30
1979	407.00	165.00	123.00	119.00
1980	435.00	(1)	156.00	(1)
1981	465.00	(1)	176.10	(1)
1985 (plan)	630.00	(1)	330–370	(1)

[1] no data.

Sources: Dienes and Shabad 1979, pp. 70–71; Wilson 1980, p. 12; and various issues of Ekonomicheskaia gazeta.

The Soviet strategy was to develop the more accessible Siberian gas fields first. In 1972, Medvezh'e began production through a 48" pipeline extended eastward from the Vuktyl' field in the Komi Republic. Evidently there were unanticipated delays in installing the necessary pipeline and compressor capacity here and as a result annual plans for total natural gas output were typically underfulfilled during the first half of the 1970s.[10] Still, by 1975 output in the Medvezh'e field was at 30 bcm, comprising then about 85 percent of all of West Siberia's output, and 10 percent of USSR output.

In the 10th five-year plan (1976–1980) the industry settled comfortably into a rapid expansion path, adding an average of 29 bcm per year during 1976–80 to bring 1980 production up to 435 bcm, the top end of the original gas plan for 1980 as announced in 1975. This experience contrasts sharply with that of the oil industry during the same period (1980 crude and condensate production was supposed to reach 620–640 million tons, yet actually only hit 603). The successes in the industry during this period reflect rapid increases in West Siberian natural gas output (as well as those from Orenburg). By 1979, Medvezh'e was producing at a rate of 69.5 bcm, about 55 percent of West Siberia's output that year (and 17 percent of total USSR output). Most of the remainder of West Siberia's output was accounted for by the Vyngapur field (a smaller field brought up beginning in late 1978, and currently producing at a rate of about 15 bcm) and Urengoi, which began production in 1978 at 11 bcm, more than doubled that to 24 bcm in 1979, and doubled again with approximately 50 bcm in 1980.[11]

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[9] Stern 1980, pp. 28–36; Dienes & Shabad 1979, pp. 87–88.

[10] The plan for 1974 was 280 bcm, yet actual production was only 261; the plan for 1975 was 300–320 bcm, yet actual production was only 289.3. For additional data see Stern (1981, p. 103), which has an interesting table comparing plans, revised plans, and actual gas outputs for the Soviet Union during 1960–1980.

[11] Dienes and Shabad 1979, pp. 87–90; Wilson 1980, p. 12; Ek. Gaz., 13 (March 1981), pp. 1–2; and Lalaiants 1981.

C. THE NATURAL GAS PLAN FOR 1981–85

By 1985, Urengoi output is planned to reach 250 bcm, five times its 1980 level. That increment of 200 bcm coincides with the planned increment to total USSR output during the 1981–85 period (195 bcm). Consequently, the key to meeting the 1985 Soviet natural gas production plan lies in Urengoi and the plans for that field are indeed ambitious. During 1981–85, Soviet plans for Urengoi call for: [12]

1. 1000 exploratory wells to be drilled.
2. Sixteen gas preparation plants to be built (each with a capacity of 15 bcm, for a total capacity of 240 bcm).
3. 6000 kilometers of intra-field and gas-collecting pipe to be laid.
4. 700 kilometers of automobile roads.
5. Construction of 1.3 million square meters of housing space and support buildings.
6. The construction of five 56" pipelines from Urengoi to the European USSR, totalling 15,000 kilometers in length, and involving the construction of approximately 120 compressor stations. Urengoi No. 6, the pipeline to Western Europe, would be in addition to these five pipelines, requiring another 4500 kilometers and 41 compressor stations.

Plans for the Urengoi field alone involve capital expenditures equal to the total for all West Siberian gas deposits during 1976–80.[13] Data on plans for other elements of the gas industry are incomplete. Until recently, official plans called for a total addition of 50 thousand kilometers of gas pipeline (of all diameters) to a system which measured 132 thousand kilometers in 1980.[14] The planned increment has since been revised downward to 40 thousand kilometers, a modest increase over the 35 thousand kilometers of pipe laid in 1976–80.[15] However, within that total the planned increment of large diameter pipe (including the line from Urengoi to Western Europe) is 20 thousand kilometers, more than twice the amount laid in 1976–80, which makes this a very ambitious plan in view of the large portion of the new pipe which must be laid in geographically inaccessible regions under harsh climatic conditions.

In 1960, natural gas output measured .761 mbdoe, 13 percent of total Soviet energy output of 9.241 mbdoe; by 1980, gas output had risen nine times to 7.10 mbdoe, and accounted for 26 percent of Soviet energy production of 26.198 mbdoe. By 1990 natural gas could account for 40 percent of total energy supplies in the USSR.[16] In two decades the natural gas industry has become a major source of energy for the USSR, and it is clear that in the 1980s Soviet planners are relying on natural gas as the critical source of new energy. The planned increment of natural gas production in 1985 over 1980 of 195 bcm is the equivalent of 3.19 mbdoe which far exceeds the planned increments to output from any other energy carrier, and, in particular, the planned increments to oil output of .54 mbdoe. The fate of Soviet energy plans for the near term essentially rests on the fate of efforts to rapidly expand gas output in Urengoi. Much less is known about whatever plans may have been made for the 1985–1990 period, but the preeminent role of natural gas seems assured at least through 1990.

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[12] Ek. Gaz., 13 (March 1981), p. 2; Ek. Gaz., 43 (October 1981), pp. 1–2; and "Velikaia stroika. . .," 1982.

[13] Ek. Gaz., 13 (March 1981), p.2.

[14] Ibid., pp. 1–2.

[15] Ek. Gaz., 43 (October 1981), p. 1.

[16] Hewett 1982, p. 29.

In assessing the realism of Soviet plans for the gas industry, the problem of reserves can essentially be ignored. Soviet estimates (which are generally regarded as accurate) suggest their "explored" natural gas reserves (equivalent in U.S. terminology to proved, probable, and a small fraction of possible) were 34 trillion cubic meters (tcm) at the end of 1981. Eighty percent of those reserves, 27 tcm, are in West Siberia.[17] That means that the USSR has control over approximately 40 percent of the world's natural gas reserves, much of them concentrated in the West Siberian supergiants.[18] Even if the Soviets were to find no more gas for the rest of this decade, their reserve position in gas is quite secure; and in fact they are virtually certain to increase reserve estimates for some time to come.

The potential barriers to realizing gas output plans lie in Soviet capabilities to manage sufficient new construction to allow the processing and transportation of the new gas. In the period 1976–1980, the increment to natural gas production was 146 bcm, fulfilling the upper end of the original five-year plan target for 1980 of 400–435 bcm. Now an even larger increment of 195 bcm is sought, much of it from fields increasingly difficult to exploit, and increasingly distant from final users and export markets. While recent Soviet successes and a strong reserve position provide some support for an optimistic assessment of the capability to meet the ambitious 1985 plans, there are some important and qualitatively new challenges which must be overcome in the next few years if those plans are indeed to be met.

D. MAJOR CHALLENGES IN THE 1981–85 GAS PLAN

There are several ways in which the plans to develop Siberian gas production during 1981–85 represent challenges to Soviet industry both qualitatively and quantitatively different from those characteristic of earlier periods. It is important to carefully analyze these challenges to determine which of them the Soviet economy can successfully overcome. Some of those which cannot be overcome solely by domestic efforts can be handled through imports from the West. It is the remainder—those challenges which the Soviets are likely to have difficulty meeting, and which they cannot or will not meet through imports—that hold in the balance the success of Soviet gas plans.

Soviet publications are full of discussions of the problems being encountered in opening up West Siberian gas fields.[19] Of the themes common to this literature, the most important are: (1) a shortage of labor and a consequent need to increase labor productivity, (2) a general lack of equipment suitable for use in extremely cold climates, (3) shortages of machinery and equipment much needed to increase output in the gas industry, which the Soviets know how to produce, but which factories have not been induced to provide in sufficient quantities, (4) a general lack of coordination on all construction projects, leading to uneven completion of projects which cannot function properly until the entire job is done, and (5) woeful inadequacy of infrastructure, including housing for workers, cultural facilities, repair and inventory facilities, and roads and communications. These interconnected themes will be discussed briefly, organized around several general problem areas.

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[17] Pravda, May 4, 1982.

[18] See CIA 1981 for world energy reserve estimates.

[19] These problems are discussed in some detail in Lisin 1981, and in "Ratsional'noe ispol'zovanie. . . ," 1981.

Despite the abundance of gas reserves in West Siberia, the Soviets must still manage to drill the wells, put in the required intrafield pipeline capacity, and install adequate gas processing capacity if there is to be sufficient gas to begin the journey in the pipelines. This has turned out to be a taxing problem, and seems destined to become more so in the future. There seem to be particular difficults in installing the Soviet-built gas processing facilities on time, and in laying the intra-field pipeline capacity.[20] This is apparently why, despite Urengoi's rapid output increases since the beginning of operation in 1978, output in that field has been below plan every year, including possibly 1981.[21] An inability to meet the schedule for gas processing plants, or the lines that feed them, will mean that even if the pipeline commissioning schedule is met, gas plans will most likely not be met. Therefore progress in this area will bear careful scrutiny by those interested in Soviet energy balances.

One of the most important challenges is the harsh physical conditions under which all operations must occur, in areas remote from cities and without adequate roads or communications.[22] Medvezh'e and Urengoi are far north, but still below the continuous permafrost line. Consequently, much of the road construction, pipelaying and drilling must be done in marshes, sometimes up to twelve meters deep, some of which do not completely freeze even in winter. Building a road under such conditions requires draining the marsh, filling it with sand hauled in from great distances, and, then, building the road on the bed of sand. Understandably there are few roads in the Siberian gas fields. Of immediate concern is Urengoi which has very few roads. The drilling and pipelaying crews have had to rely instead on helicopters and fixed-wing aircraft to move equipment and people, a very expensive proposition.

Pipelaying in these conditions is particularly difficult, involving problems unique by world standards. In West Siberian swamps the pipelaying has traditionally been done during October-March when roads could be built on packed snow and ice (although there is now some attempt to move to year-round construction). Because some of the swamps do not completely freeze in winter, simply laying the pipe is itself a tremendous challenge. The Soviets have evidently developed a four-ship pipelaying complex specially designed to work on the swamps, but it is experimental, and the general rule seems to be to use more ad hoc approaches developed in the field. After the pipe is laid, it is subject to enormous stress year-round, in the winter as frost pushes it up, and in the summer as it tends to float in the swamp. This has evidently led to numerous breaks in pipelines. The challenges the Soviets face here are, to some extent, unique even by comparsion to those problems oil companies faced in building the Alyeska pipeline. That was an oil pipeline (hence, heavier and more stable), about one-half of which was laid above ground in permafrost and built on a sophisticated set of supports.

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[20] Pravda, June 6, 1982, p. 3.

[21] For a discussion of earlier years see Wilson 1981, p. 13. As the recent Pravda piece (ibid.) makes clear there was a shortfall below plan of 30 bcm in new processing capacity. But existing plants were run at rates over their rated capacity to make up some of the difference. They probably did not make up all of the difference, hence the likelihood that the plan for Urengoi was underfulfilled.

[22] See Trofimuk 1980; the interview with T. Nesterov (director of the West Siberian Oil Institute) in Leningradskaia Pravda translated in Foreign Broadcast Information Service: Soviet Union, January 19, 1981, pp. S1–S2; Wilson 1980, p. 32; and Sanders 1980.

The harsh climate and remoteness of the fields creates large demands for new infrastructural investments, demands which planners have been unwilling or unable to meet to anything approaching an adequate degree. Throughout West Siberia, but particularly in the northern gas fields, dwelling conditions are very poor, even by general USSR standards. In Novourengoi, a town of 18,000, most of whom work in the gas fields, 14,000 live in dormitories or railroad carriages.[23] In Medvezh'e, in recent years, the output plan has been met, but the plan for investment in infrastructure has been only half fulfilled. Many workers live without their families; and families which are there live without even modest amenities (milk and bread factories, pre-schools, and so on) available in even small towns in the European USSR. These substandard living conditions, coupled with the inhospitable climate, are a major factor contributing to a severe labor shortage and to a very high labor turnover on the oil and gas fields, which affects labor productivity.[24]

In addition to the human costs of inadequate infrastructural invesment, there are more tangible economic costs associated with inadequate provision for inventory accumulation, a lack of repair shops, and inadequate roads, communications, and power supplies. In Urengoi, the lack of hard-surface roads has led to multi-month delays in opening up new tracts. Moreover, as drilling and pipe crews move into the less accessible parts of the field, and then on to the much less accessible tracts farther north in Yamburg, the potential for lengthy delays grows much more serious. Right now, planners in the region calculate that road building should proceed at a rate three times that of the past, yet there is no increase in the number of workers assigned to the task.[25]

The symptoms of disorganization in West Siberia are discussed with great frequency in many Soviet publications. For example, one method to increase the throughput of pipelines, and therefore reduce the need to construct new pipelines, is to chill the natural gas. The Soviets have begun to construct gas preparation plants at Urengoi with refrigeration capabilities—the first with a capacity of 10 bcm has been completed—but when they can be put to use is in question.[26] The difficulty is that power lines were supposed to be extended from the Surgut hydroelectric power station, but were not. There is therefore a power shortage in the area, and the refrigeration units cannot be used. Similarly, because hydroelectric power is unavailable, about 10 percent of the gas which begins the pipeline journey to the European USSR is used to run compressors necessary to get the rest to its destination.[27]

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[23] Petroleum Economist, July 1980, pp. 311-12.
[24] Lisin 1981.
[25] Ibid.
[26] Wilson 1980, p. 28.

The shortage of electric power also contributes to problems in drilling. One Soviet economist has estimated that about fifty gas wells a year are "lost" because slower, diesel-powered systems must be used rather than advanced electric drilling techniques. In other cases, electric power is produced on-site using portable gas-fired power plants which are highly inefficient both in terms of energy and human input.[28]

The general problem is an astounding lack of coordination among the exceedingly numerous organizations somehow involved in the development of West Siberia. Each construction project usually has more than one contractor and no general contractor on-site to supervise activity and coordinate the various sub-projects. The most glaring example of the problems involved is in the crucial area of pipelines, where the lines and the compressors are constructed by different organizations. Typically, the pipelines are finished first, only to work at far below capacity while the compressors are brought on-line. It is not unusual for the Soviets to take two years to get a pipeline up to full capacity.

Soviet planners acknowledge that this lack of coordination among the various organizations is crippling efforts to increase energy production and attempts are being made to change the institutions which supervise the development of West Siberian energy sources. There is now a new Interdepartmental Territorial Commission on the Questions of the Development of the West Siberian Oil and Gas Complex which is attached to the State Planning Committee. That organization was set up in Spring 1981, and it is too early to assess its effectiveness, but initial indications are that it does not have the necessary authority to take direct and on-site command of the entire energy development process in Tiumen'. The institutional impediments to achieving smooth coordination of Siberian energy development are the same as the impediments encountered in attempting to accomplish any fairly complicated task in the USSR: the ministries jealously guard their territory and resist surrendering their sovereignty to any other authority, irrespective of the effects on the general welfare.[29]

The absence of roads necessitates heavy reliance on helicopters and fixed-wing aircraft. Although there are no data available on the number of aircraft involved, it is obvious that the numbers are significant and growing rapidly. This is, of course, not necessarily uneconomical. It probably is cheaper in some cases to rely on aircraft rather than to construct roads in the very difficult terrain of Urengoi. Nevertheless, there are probably fewer roads than the economics of the fields would justify. The contributing factors are a shortage of labor and a lower priority given to infrastructural investments.

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[27] "Ratsional'noe ispol'zovanie . . .," 1981.

[28] Lisin 1981.

[29] See the interview with V. Kuramin (chairman of the Interdepartmental Commission) in Sotsialisticheskaia Industriia, June 1981, p. 1; and a more recent discussion by Kuramin in Pravda, March 3, 1982, p. 2.

The air transport is particularly burdensome because much of the Soviet-made machinery and equipment used in the fields, for example Soviet-built compressors for gas preparation, is unusually heavy by world standards. The incentive to produce heavy products is quite strong and deeply ingrained in Soviet economic institutions; and there is little prospect of immediate relief except through massive imports of lighter Western equipment. It is not surprising, therefore, when one reads complaints such as voiced recently in Pravda that the Barricade drilling rig factory in Volgograd has increased by 116 tons the weight of the derricks it sends to Tiumen' Oblast, without any increase in the capacity of the rigs.[30]

The weight of Soviet machinery is one manifestation of the tremendous problems Tiumen' gas workers are encountering because Soviet industry does not produce machinery and equipment suitable for the conditions of Tiumen'. Soviet factories show a marked lack of enthusiasm for developing pipelaying equipment suitable for operation in arctic conditions. For example, in one of the major construction organizations working in Tiumen' Oblast, Glavtiumen'neftgazstroi, only 15 percent of their 5500 transport units are suitable for arctic conditions. The remainder of the equipment is of general design most suitable for use in the European USSR. When this equipment is operated under arctic conditions, oil must be changed with great frequency, glass shatters, there are frequent breakdowns, and the equipment wears out faster.[31] It is not that Soviet factories cannot produce equipment suitable for operations in these harsh conditions, but rather that the incentive system in the Soviet economy does not encourage factories to meet these special customer needs.

There is a similar problem with large diameter pipe. The portion of the gas pipeline laid in West Siberia must be insulated, either at the site, or beforehand at the factory. The latter is far more efficient, in particular because it saves on labor in Siberia. Nevertheless, Soviet factories are very reluctant to insulate pipe before it is shipped, apparently because their bonuses are mainly a function of pipe output, and insulation activities divert the workforce from producing pipe.[32] Thus, most pre-insulated pipe for Soviet pipelaying crews is imported from the West.

The Soviets would very much like to upgrade the quality of large-diameter (56") pipe they produce in order to increase pressures from the current 75 atm to 100 or 120 atm. This would allow them to increase throughput by up to 20 percent and consequently decrease the need for new pipelines out of West Siberia. The E. O. Paton Welding Institute in the Ukraine has developed a 56" laminar (multiple layer) pipe capable of meeting those parameters, and the 1981 plan was to produce one million tons of the new pipe at the Kartsyzk Rolling Mill in the Ukraine.[33] It is doubtful that this target was met because Soviet factories are slow in changing the product mix toward the new pipe.

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[30] Salmanov 1981.

[31] "Ratsional'noe ispol'zovanie . . .," 1981, p. 52.

[32] Shaikhutduhov et al. 1981.

[33] Oil and Gas Journal, June 15, 1981, p. 55.

The same applies to Soviet-produced turbines.[34] The 56" gas lines which play so prominent a role in current Soviet plans transport the gas most economically when 25 megawatt (MW) turbines are combined with compatible compressors to maintain pressure in the line. Soviet industry has been working for well over a decade in an attempt to develop turbines of that size, and of a reliability similar to 25 MW turbines produced in the West, but with disappointing results. As a consequence the 56" lines installed to date have either had to rely on turbines and compressors imported from the West, or on the much more costly alternative of equipping each compressor station with a large number of lower capacity (and less reliable) Soviet-built turbines.

A common theme in these cases is that the Soviet research establishment is responding to the special challenges of West Siberia far more effectively than Soviet industry. Soviet industry knows how to produce better pipe, better turbines, and better arctic equipment, but the incentives are very weak to induce it to do so. This is not a problem unique to those firms producing for the energy sector, but rather it is a general problem throughout the Soviet economy. The typical Soviet manager has very little reason to try to satisfy the special needs of customers, even if those customers happen to be buying for a high-priority export sector such as energy. There are no quick fixes, no decrees, that can easily change this situation. Short of a major economic reform the only possible, and most likely ill-fated, policy would be to shift the gas industry into the category of a "military" sector with all the high-priority that implies. And indeed that is apparently what is happening in FYPXI.

The shortage of labor for West Siberia in gas projects is traceable in part to the problems with technology. In addition to the above-mentioned unnecessary requirement of insulating pipe in the field, compressor stations could be constructed in modules, flown to the site, and then reassembled, which would save tremendously on labor. Yet, Soviet factories will not produce modular units, in part because it is hard to achieve the degree of coordination among all their suppliers necessary to run modules off of an assembly line. Moreover, there is a great deal of labor wasted on unnecessary repairs and delays because equipment is inappropriate or of poor quality, or because of the absence of adequate repair facilities.[35]

The labor shortage has become sufficiently severe that Soviet planners have begun regularly to fly in construction workers, drilling teams and other skilled workers to Tiumen' from the European part of the USSR. For example, in Tiumen', 11,000 workers (primarily drillers) are flown in twice a month from Azerbaidzhan, Byelorussia, the Ukraine and elsewhere to supplement the Siberian workforce.[36]

Pipelines and compressors are the key, though not the sole, bottleneck holding back gas output, and all of the considerations discussed above bear on the pipeline plans. At the end of 1980, the USSR gas trunkline system was 132 thousand kilometers in length, of which 12 thousand kilometers were 56" pipe. During 1981–85, the most recent (October 1981) plans are to expand the system by 40 thousand kilometers, of which 20 thousand are to be in six 56" pipelines out of Urengoi. The plan implies the entire 40 thousand kilometers of new pipe will require an additional 320 compressor stations.[37]

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[34] Campbell 1980, pp. 213-218.
[35] On the repair facilities see Lalaiants 1981.
[36] Petroleum Economist, July 1980, p. 311.

The most important component of this plan is the six big lines out of West Siberia, including the line designated solely for export to Western Europe. Plans for the six lines are the following:

1. Urengoi to Moscow on a northern route via Punga and Griazovets. The pipeline was completed in April 1981 and is now reportedly being extended through Torzhok and Minsk to Ivatsevichi.
2. Urengoi to Petrovsk (south and slightly east of Moscow). This line was originally scheduled to be finished by April 1982, but the plan was revised for completion in December 1981, and reportedly that did indeed occur.

3. & 4. Urengoi to Yelets (southwest of Moscow). Evidently neither yet under construction.

5. Urengoi-Novopskov (southwest of Yelets and Moscow). The first portion, originally scheduled for completion in 1983, is now scheduled for completion in late 1982.
6. Urengoi No. 6 to Western Europe, running close to the central route and through Czechoslovakia and Hungary. This is in the final stage of negotiation and construction has commenced.

In addition, there were originally plans for two lines out of Yamburg to Yelets. These have now both been delayed, but work may begin on one of them in 1985. Nevertheless these are still very ambitious plans, particularly in terms of the anticipated pace of construction. In 1976–80 the new large-diameter pipelines were coming up one every two years. Now, the plan is to average one every ten months.

Originally the planned capacities of these lines were in the 28–34 bcm range, implying the use in some of the new laminar pipe and chilling. Currently plans call for lines commissioned through 1982 to be at 75 atm, which means 28 bcm per year. It appears for the latter part of the five year plan period there is still an intention to construct one or two lines using the new laminar pipe, with a capability to transport gas at at least 100 atm (which brings throughput into the 30–34 bcm range). The total length of the lines is to be 20 thousand kilometers including the line to Western Europe. This implies approximately 160 compressor stations (each equipped with three 25 MW compressors) of which 41 will be for the 5 thousand kilometer line to Western Europe.[38]

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[37] Ek. Gaz., 43 (October 1981), pp. 1–2.

[38] With the use of the laminar pipe, and higher pressures, the number of compressor stations could well rise.

E. THE FEASIBILITY OF THE 1985 GAS OUTPUT PLAN

Most of the factors which could prevent the Soviets from attaining the planned 630 bcm level for natural gas output in 1985 involve either failure of equipment itself, or failure in construction. The equipment failures, which might involve difficulties in meeting pipe or compressor plans, an inability to develop better equipment capable of working in the arctic, and so on, could be compensated by imports from the West. This would require additional borrowing, and pressure on the Soviet hard-currency balance of payments, and would interact with what will probably be poor economic performance in the remainder of the system. Nevertheless, if the only potential impediment to meeting the gas plan is insufficient domestic supplies of equipment available from the West, it is quite likely that somehow Soviet planners will find the wherewithal to import this equipment.

Construction failures are another matter. It is virtually certain that problems in infrastructural investment will persist, and so will the labor shortage. The institutional weakness observed in the last decade will continue to exist well into this decade. Major institutional changes in the Soviet economy are unlikely even to begin until the transition to the post-Brezhnev era is well underway. It is therefore quite conceivable that the Soviets will encounter difficulties in the next few years in bringing both the gas processing facilities in Urengoi and new pipelines up to their rated capacity, and therefore meeting natural gas output and export targets. These problems would arise not because of difficulties in finishing the pipelines themselves, but rather difficulties in bringing on compressor stations rapidly enough to move the pipeline throughputs up to full capacity within the targeted time. This will be a problem even if the compressors are imported. As long as Soviet construction crews are used to build the stations themselves there will most likely be delays in bringing the stations on-line.

Soviet leaders are acutely conscious of the magnitude of these problems and are exerting considerable efforts to try to overcome them. In mid-August of 1981 Vladimir Dolgikh, the Secretary of the Communist Party responsible for the energy industry, chaired an important meeting of all concerned industrial authorities involved in the gas industry. It was made quite clear at the meeting that Soviet leaders placed the highest priority on meeting gas output plans and speeding installation of pipe and compressors.[39] And, indeed, there is ample evidence in the Soviet press that every effort is being made to speed pipeline construction (the list of the six pipelines shows some of the amended deadlines).[40] This aceleration is probably prompted in part by concern over continuing difficulties in the oil industry, and therefore a desire to speed the development of gas supplies. However, there also must be an element of concern that unless very visible high priority is given to the gas plans, actual construction will lag behind even original plans.

Since equipment can affect construction time, one determinant of the realism of the 1985 plan is the level of imports of Western equipment authorized by Soviet planners. High import levels of insulated pipe, of equipment suitable for use in the arctic, and other labor-saving equipment will aid in meeting the plan. Thus, as planners run up against what probably will be continued failures by Soviet industry to rise to the challenge implied for them in the gas plan, liberal use of Western equipment will allow them to overcome a good deal of the potential shortfall which might otherwise occur.

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[39] Pravda, August 15, 1981.

[40] See for example "Velikaia stroika . . .," 1982 for a piece illustrative of the high priority now accorded gas pipeline construction in the Soviet Union.

F. URENGOI NO. 6

Early preparatory work for Urengoi No. 6 is now under way, and construction activity will begin very soon, with an anticipated completion date in 1984.[41] The precise projected capacity of the line is somewhat of a mystery, although it is likely that it will be well below the 35 bcm in new contracts which could result from current Soviet negotiations with Western Europe.[42] The line will span approximately 4500 kilometers of Soviet territory, accounting for almost 25 percent of the total 20,000 kilometers of new large-diameter pipeline to be commissioned during FYPXI. It is to be built relying almost exclusively on pipe, compressors, and turbines imported from western countries. Judging from publically available information on pipeline and compressor station contracts, the total hard currency cost of Urengoi No. 6 should be somewhere around $5 billion, far below the $10–$15 billion which is frequently mentioned in the press.[43]

Simultaneous with the construction of Urengoi No. 6 Czechoslovakia is expanding its transit capacity by 16.3 bcm, and Hungary will be adding 16 bcm–18 bcm of new capacity, for a total of 32–34 bcm of new capacity. In addition there is apparently approximately 6 bcm in excess capacity in current Czech transit capacity.[44] This suggests that by 1985 Soviet planners will have the capacity to export at least 65 bcm of natural gas to Western Europe.[45]

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[41] Izvestiia, February 18, 1982, p. 2.

[42] Original discussions in the Western and Soviet press suggested a 56" line with a capacity to ship 40 bcm, which would have required both chilling and pressure increases will above the current 75 atm. (Current Soviet lines have a capacity at the far end of 28 bcm, operating without chilling and at 75 atm.) But recent discussions of Urengoi No. 6 suggest a capacity of no more than 32 bcm. (For example in Izvestiia, February 18, 1982, p. 2.) This is also the implication in a TASS dispatch reported in the Foreign Broadcast Information Service: Soviet Union, November 24, 1981, p. S9. This does not imply any difficulties for the Soviets in having the capacity to meet their new natural gas export commitments since the existing gas distribution system has or will develop excess capacity fully capable of meeting the new export commitments, and then some. For example the Soiuz line itself probably has at least an additional 12 bcm in export capacity. West European contracts to buy Soviet gas are not all concluded, although two of the critical contracts for gas shipments to France and West Germany have been concluded for a total of 18.5 bcm per year at full flow in 1987. (Shipments begin in 1984 and gradually build to that.) A large contract with Italy, and smaller contracts with other West European countries, could bring the total up to approximately 35 bcm at full flow in 1987.

[43] The line should require approximately 3 million tons of 56" pipe (assuming 700 tons/kilometer and a 4500 kilometer line). There is very little price information available, but what there is suggests Germany and Japan are selling the pipe to the Soviets for $600 or less per ton (Financial Times, July 22, 1981, p. 4; Japanese Economic Journal, July 21, 1981, p. 6). Thus the total pipe contracts should total less than $2 billion. The line will require 41 compressor stations, each with three 25 MW turbines in them. The Creusot-Loire contract for 22 of the compressor stations is reportedly valued at $948 million (Wall Street Journal, September 30, 1981, p. 33). Assuming that figure representative for all of the compressor stations (and that it covers spare parts), then the compressor stations should add no more than another $2 billion. Finally there are valves, fittings, special pipe for the compressor stations, pipelaying tractors, and so on. I will assume, based on scattered sources, that these total no more than $1 billion.

[44] FT (Financial Times) East European Markets, November 16, 1981 and March 22, 1982.

G. A PREDICTION FOR 1985

Any prediction for 1985 must involve a great deal of speculation because of only an incomplete picture of Soviet capabilities, and virtually no knowledge of the detailed calculations underlying Soviet gas plans. It is tempting to be swayed by the stories in the Soviet press, and to take the position that the chaos evidently rife in West Siberia will lead to significant underfulfillment of the plans. However, anyone who has observed the Soviet economy over a long period knows that some amount of chaos is normal, yet strangely does not paralyze this system. The Soviets have been muddling through for quite some time, and there is no particularly strong reason to suggest that capability is lost in West Siberia. Furthermore there is ample evidence in recent months that the Soviet leadership has given natural gas pipelines a very high priority, signalling an all-out effort to fulfill the natural gas plan.

Nevertheless, these plans should be viewed with some skepticism. It is only in recent years that the Soviets have been able to meet the gas output plans set for themselves, and the plans for 1981–85 call for qualitatively and quantitatively higher levels of effort from a system stretched very thin because it has been muddling through for so long. In addition, while U.S. sanctions on high-technology (and all energy technology) exports to the USSR have not yet substantively affected the timetable for Urengoi No. 6, they appear to have had an effect on Soviet plans for the use of foreign equipment on the other five gas pipelines. The original intention of Soviet planners was probably to rely rather heavily on western pipe and turbines for several of these domestic lines, with the expectation that the lines laid in 1984–85 could be built primarily with 56" pipe and turbines built by Soviet factories. In fact now there are growing signs that the Soviets are attempting to rely quite heavily from the very beginning on their own equipment, and that in order to do that they have speeded up plans to institute serial production of their 56" laminar pipe and their own 16 MW and 25 MW compressors.[46]

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[45] Soviet capacity to ship natural gas to the East European border could easily exceed that figure by another 30 bcm in 1985. The northern route line (number 1 above) which is now being extended to Ivatsevichi could easily be made into an export line with a relatively short extension to the Czech border, as could one of the central route lines not stopping in Kiev. Therefore to understand Soviet intentions for gas exports to Western Europe in the future it will be important to watch for developments in East European transit capacity (as well as for West European contract negotiations).

[46] Nothing beyond circumstantial evidence can be cited to support any of these conjectures. On the notion that Soviet intentions were originally to rely heavily on western equipment for most of the lines installed in 1981–85, note that original Soviet plans for their natural gas pipelines seemed to imply that only the last two lines out of Yamburg would be built with the new laminar pipe. (Oil and Gas Journal, June 29, 1981, p. 41.) Now efforts are underway to set up production at two factories and there is an obvious intention to use the pipe for a significant portion of the domestic lines, as well as a short section of Urengoi No. 6 (Trud, February 9, 1982).

For the 25 MW compressor which has been in an experimental stage since the mid-1970s, the intention until recently was not to begin serial production until some time in 1983 (Velikanov 1981). Now Soviet planners appear to be trying to speed up that process, possibly in response to balance of payments problems and U.S. sanctions. This could explain why turbine production in the USSR is (in terms of MW) far below its 1980 level (1981 production was 80 percent of 1980,

Continued

In attempting to rely heavily on Soviet-produced equipment for the expansion of their large-diameter pipeline system Soviet planners are directly struggling with the inability of industry to produce in large quantities, and in a timely fashion, high-quality machinery and equipment. There is no reason to believe that the mere fact of a high political priority being given to the gas industry will fully eliminate this weakness; and therefore it seems certain that the attempt to rely on Soviet equipment will contribute to delays in realization of the gas output plans for 1981–85. This does not mean that the six pipelines will not be laid; they will probably all be down by 1985. And Urengoi No. 6 will most likely be operating at full capacity by 1986 or 1987. But for the other five lines it is likely that there will be delays in bringing those lines relying on Soviet-built 16 MW and 25 MW turbines up to full capacity, and keeping them there, because the turbines will be far less reliable than western-built turbines. Furthermore there will be a general problem in getting all of the lines up to full capacity simply because of the immense organizational difficulties, labor shortages, and so on, discussed earlier.

Even if Soviet planners were to reverse the policy of relying on domestic turbines and pipe and shift to heavy reliance on western equipment for the five domestic lines, they would still probably not be able to meet the plan of 630 bcm by 1985. All of the organizational impediments seem so formidable that it seems unlikely they will be able to commission more than Urengoi No. 6 and the equivalent of four of the domestic lines at full capacity by 1985. That would still imply a rate of construction twice that of the previous five year plan, a considerable accomplishment. In this case natural gas output in 1985 would be approximately 600 bcm, which seems a reasonable guess at a ceiling for output in that year. If planners persist in their attempt to tool up Soviet industry, particularly the turbine industry, to handle the bulk of incremental equipment orders, then output will probably fall below 600 bcm; and gas supplies will be increasingly erratic as frequent breakdowns plague the system. My guess is that Soviet planners place so much importance on the natural gas output plans that they will be forced to turn to Europe and Japan for substantial credits in order to buy turbines, pipe, and other equipment.

Whatever happens to the domestic system, it is likely that Urengoi No. 6 will be brought up to full capacity by 1986–87, not only because it is virtually totally built with western equipment, but also because it is apparently the highest priority of the six high priority lines. But if the other lines do not get to full capacity as planned, and if supplies of other energy carriers grow progressively weaker, then the Soviets could encounter difficulties in filling that line.

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and the first quarter of 1982 was 86 percent of the first quarter of 1981), the hypothesis being that output is falling as factories switch to producing the new turbines. In the interim, it appears that the soviets will rely heavily on their 10 MW compressors (see for example Makhlin 1982).

III. IMPLICATIONS OF DEVELOPMENTS IN THE SOVIET NATURAL GAS INDUSTRY FOR EAST-WEST TRADE AND COOPERATION

Soviet natural gas exports will be an increasingly important source of hard currency in the 1980s. On the margin, they will surely be the only source of increased Soviet energy exports to all customers; and, in fact, it seems quite likely that on hard-currency markets (primarily Western Europe) gas will quickly move in to replace falling oil exports.

As the previous discussion makes clear, this rapid development of the gas industry implies enormous investments at a very quick pace. This will probably involve large imports from the West, particularly Western Europe and Japan, of pipe, compressors, and other equipment; and it will mean a significant increase in Soviet debt to the West during the next few years (a good portion of it suppliers' credits). This drive also implies a significant increase in Soviet capacity to export natural gas westward, which has implications for hard-currency earnings, possibly of critical importance in light of growing difficulties in the petroleum industry. Finally, rapid increases in natural gas exports imply increasing West European dependence on Soviet energy exports, a matter of deep concern in the Reagan Administration, and some concern throughout Western Europe. This section discusses these issues in order to arrive at an informed assessment of the importance of developments in the Soviet gas industry for the USSR and for the West.

IV. IMPLICATIONS FOR ENERGY EQUIPMENT IMPORTS FROM THE WEST OF DEVELOPMENTS IN THE SOVIET NATURAL GAS INDUSTRY

The six 56" pipelines out of West Siberia will account for the majority of Soviet needs for Western equipment in the development of the gas industry. The 20 thousand kilometers of line for the six will involve a total requirement of no more than 14 million tons of 56" pipe during 1981-85, and 160 compressor stations, each ideally equipped with three 25 MW compressors. Much of the equipment for these lines will probably be needed by the end of 1984 to allow for uninterrupted supplies for pipelaying crews through 1985. As a rough approximation we shall assume all the equipment deliveries occur in 1981-84, although delays in pipeline construction could stretch this out one to two years.

Data on the quantity of 56" pipe the Soviets produce are not available. The production of all pipe over 40" has been about 3 million tons during 1981-85, most of it in 1981-4, which means roughly 2.5 million tons per year, and it would be surprising if the production of 56" pipeline were even 1 million tons per year.[47] More importantly, Soviet pipe, and the welding techniques associated with it, is capable of the 55 atm, which limits throughput to well under 28 bcm per year.[48] Consequently only the new laminar pipe discussed in the previous section (which could handle up to 120 atm) will be suitable for the five domestic lines. Even if the Soviets manage production of that pipe at a rate of 1 million tons per year for 1983–85, that leaves a demand for pipe imported from Germany and Japan of at least 10 million tons during 1981–85, most of it in 1981–84, which means roughly 2.5 million tons per year. Of that total, 3.2 million tons will be for Urengoi No. 6, the remainder being devoted to the five domestic lines.[49] At current prices the importation of, say 2.5 million tons of 56″ pipe per year during 1981–84 would represent an average of about $1.5 billion per year in order for West European and Japanese pipe manufacturers, and a roughly equivalent annual gross increase in Soviet short-term debt.

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[47] Soviet data only report all pipe production which has stagnated in recent years. Campbell (1980, p. 210) has found data for selected years on the proportion of that which is a diameter of 40" and above for the period through 1976. In recent years that has worked out to 3 million tons per year. No data are available on the amount of 56" pipe in that total, but it cannot be terribly large.

[48] Campbell 1980, p. 212.

Because the pipeline program implies very high levels of demand for large compressor stations which must be installed quickly, it is likely that a substantial protion of the equipment for the 160 compressor stations for the six lines will eventually have to be imported from the West. Not enough is known to make much more than a guess here. I will assume that of the 160 compressor stations needed for large diameter pipe, the Soviets will import no more than 125, sufficient for all of the West European line and three of the domestic lines, while somehow using domestically-produced compressor stations for two of the remaining domestic lines. If 125 stations are imported, their value at current prices will be approximately $6.5 billion, or $1.625 billion per year for four years. If they were forced to import all 160 compressor stations, then, the hard-currency cost would be approximately $8 billion, or $2 billion per year.

Aside from pipe and compressors, there will be other equipment imports associated with the new 56″ pipeline plans, for example, pipelaying equipment. There are no good data available for estimating the value of those imports, but they will be far less than the pipe and compressor imports. These uncertainties, questions about the eventual magnitude of pipe and compressor imports, and the potential for inflation in prices for all gas industry equipment between 1981 and 1984 mean that it is impossible to give a point estimate of the eventual total value of equipment imports associated with gas pipeline expansion in the Soviet Union. A reasonable range would seem to be imports of $15–20 billion bunched in 1981–84, which would be an average of $3.75–5.0 billion in imports per annum over those four years. These imports will be financed by a combination of government, bank and supplier credits, most of which will be repaid during 1985–1994 out of dollar proceeds from gas sales. These figures could go significantly higher only if the Soviets resort to use of foreign construction crews on new pipelines, which seems unlikely, although not inconceivable. Of course, in nominal terms, imports could be much higher if pipe and compressor prices rise considerably during the next few years.

The costs of financing these imports will probably average at least 7.5 percent per annum, meaning that, on average, interest costs will rise in 1982 by approximately $.280–.375 billion (assuming annual equipment imports of $3.75–5.00 billion, respectively), and continue to rise by that amount through 1985, when the total interest payments due to gas investments are running $1.125–1.50 billion. After this point, interest payments will begin to fall as the debt is repaid through incremental gas exports.

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[49] Given current difficulties in the Soviet steel industry, and a stagnation in total pipe production, it is conceivable that virtually all of the pipe needed for the six lines plus the West European line will be imported.

There is no obvious reason why the Soviet economy cannot handle the new debt involved, and liquidate it in an orderly fashion via gas sales (of which more below). Problems in international relations could create some difficulties in borrowing the money, but anything short of a very major East-West confrontation would probably involve a short-term interruption, rather than a long-term change, in the flow of credit. On the other hand, if petroleum exports fall rapidly, gas will not be able to fully replace them, and in any event the f.o.b. value of gas to the Soviet economy will be substantially lower (on a calorific basis) than that of petroleum. Therefore, it is possible that in spite of vigorous growth in Soviet gas exports, there could still be increasing general hard-currency difficulties for the Soviet economy through the mid-1980s.

V. IMPLICATIONS OF DEVELOPMENT OF SOVIET NATURAL GAS FOR SOVIET ENERGY EXPORTS, AND FOR WESTERN EUROPE'S ENERGY IMPORTS FROM THE USSR

Substantial Soviet natural gas exports are a recent phenomenon. For most of the early 1970s, the Soviets were net importers of gas, In 1975, total Soviet gas exports were 19.33 bcm, of which 10.7 went to Eastern Europe, and the remainder went to Western Europe. Imports that year were 12.4 bcm, the majority coming through IGAT I from Iran; thus, net trade was only 6.93 bcm. By 1980 gas exports were up to 55 bcm, which is .9 mbdoe; exports to Western Europe were 25 bcm, or .41 mbdoe. Imports in 1980 were probably no more than 3.5 bcm, so that gross and net exports were almost the same. Earnings from the 25 bcm of gas exported to Western Europe were probably something like $3 billion, assuring an average price for gas exports of $20 per barrel of oil equivalent.

Petroleum exports in 1980 were approximately 3 mbd, of which 1.1 was to Western Europe, the remainder to Eastern Europe, Cuba, Vietnam and Cambodia. The 1.1 mbd to Western Europe probably brought an average price of $35/barrel, yielding total receipts of a little under $14 billion. An important point is that oil is worth a great deal more than gas on a calorific basis. In 1980 prices, the Soviets needed to increase gas exports by 1.75 mbdoe in order to replace in dollar terms a 1 mbd loss in oil exports. That gap will narrow, however, in the 1980s.

There are two ways in which to estimate probable Soviet gas exports to Western Europe for hard currency in 1985. One is to sum contracts under negotiation, or coming into force through 1985; the other is to calculate the Soviet gas export capacity by 1985 in the pipeline network. Of course, the latter does not guarantee exports; that is determined by the total energy balance, a point discussed briefly below.

As discussed earlier, Soviet capacity to export gas through Eastern Europe will be at least 65 bcm by 1985, an increment of 40 bcm to current capacity. It could be higher by then, but it would require investment decisions about which nothing is known at present. More importantly there is every indication that the Western European countries as a group will not be ready by 1985 even to receive an additional 40 bcm. The way negotiations are going now, the Soviets will be fortunate to increase gas exports by 35 bcm in 1985 or 1986, which would make total gas exports 60 bcm. I will use that as the forecast with the caveat that it is probably at the high end of what is reasonable.

Softening of the gas market showed up in the results of the critical price negotiations between Ruhrgas and the Soviets (which in effect set the price for all the new gas). The Soviets had hoped for a base price of about $4.00 per mmbtu (million btu; equals $21.60 per barrel of oil equivalent to be in effect at contract signing, with an escalation clause linked to petroleum product prices, and a guaranteed minimum price of $6.00 per mmbtu at the time deliveries commenced in 1984. The downward revisions in natural gas demand projections in Europe make it quite likely that the guaranteed minimum price would be the actual price, and the negotiators focused on that issue. Eventually the Soviets were forced to accept a guaranteed minimum price of $5.70 per mmbtu ($30.78 per barrel of oil equivalent), and that will most likely be the actual price in 1984–85. Assuming exports of 60 bcm (the current 25 bcm plus an additional 35 bcm), and that the new price applies to all of those exports, the gross value of gas exports at full flow (1986 or 1987) will be about $11.0 billion.

Not all of these receipts will be available for imports of grain, intermediate products, machinery and equipment. Principal and interest payments from the borrowing of the 1981–85 period will be at their peak by 1985–1986, running approximately 2.6–3.5 billion, assuming the credits are repaid during 1985–1994. In 1985 Soviet gas shipments will probably not greatly exceed in value terms those payments because of only a partial flow through the line. However by 1986–87 the gas will be at full flow, in which case net new hard-currency earnings from natural gas will be approximately $7.5–8.4 billion in current prices. Rapid increases in energy prices between now and then will, through the agreed escalation formula, increase Soviet gas export prices and therefore increase hard currency receipts above 11 billion.

Coverted to 1980 prices, this amounts to less than one-half of 1980 Soviet hard-currency earnings from oil and gas exports to developed Western countries (using an estimated $17 billion in 1980). Oil production problems might be so severe by 1985–87 that there will be little, if any, net Soviet oil exports to the West, so that the $7.5–8.4 billion will be all they can count on for this, their major source of hard currency.[50] That implies a significant shortage of hard currency for the Soviet economy relative to the 1970s, but not a catastrophic shortage. Presumably, there would be enough to handle grain imports and some small amount of machinery and equipment imports; and Soviet credit-worthiness could still be good enough to merit further loans. It does imply significant stress in the Soviet-East European relationship.

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[50] Hewett 1982.

VI. CHANGING WEST EUROPEAN DEPENDENCE ON SOVIET ENERGY EXPORTS

In 1979, OECD Europe imported 1.17 mbd of oil from the USSR and 23.0 bcm (.43 mbdoe) of gas, representing, respectively, 10 percent of all of OECD Europe's net imports of oil, and 100 percent of their net imports of gas (28 percent of gross imports).[51] In 1980 Soviet oil exports had fallen to 1.11 mbd, and gas was up to 25.5 bcm (.42 mbdoe),[52] and although the data are not available, the percentage dependencies in 1980 were surely similar to those in 1979. The total gas plus oil exports of 1.53 mbdoe in 1980, which was probably less than 6 percent of OECD total energy use that year, was quite likely a peak for Soviet exports for the 1980s.[53] In calorific terms, it seems likely that in 1981, and probably throughout the early part of the 1980s, petroleum exports will fall faster than gas exports rise. Therefore, in terms of total energy, Western Europe will be importing less from the Soviet Union in the early 1980s than it did in the late 1970s.

It is the shift from oil to gas that is troubling a number of people in the West, primarily officials in the Reagan administration. Gas supply relationships are different than oil supply relationships. The great capital expenditures which must precede the shipment of natural gas by pipe or tanker create in the buyer a dependence on the seller which is far more pronounced than in the case of buyer-seller relations in oil. In the oil market, if a seller tries to ask an exorbitant price, the buyer simply switches to other buyers, and other tankers. Thus, the Soviet gas pipeline, and subsequent gas shipments to Western Europe imply somewhat more interconnection between Western Europe and the USSR than equivalent oil sales would imply.

This is all the more bothersome because in gross terms the Soviet Union could well be one of the few major suppliers of natural gas to Italy and West Germany by the middle of the 1980s. Right now, the USSR accounts for 60 percent of Italy's gross gas imports, 25 percent of West Germany's imports, and 14 percent of France's imports. By the mid-1980s all of those numbers will probably be higher, in particular for West Germany (the source of most concern to the Reagan Administration), it could be in the 40 percent range.

Despite the fact that gas does differ from oil, and that the USSR's role in West European gas supplies will certainly grow, it would appear that far too much is being made of the potential deleterious effects of the increasing interdependence this implies. As the above analysis has shown, the USSR will very much need the hard currency receipts from gas sales, and will not lightly jeopardize them through a cutoff. Their record in the past concerning agreements of this sort is quite good and it seems very unlikely that they will jeopardize that record unless there is a major break in East-West relations. And should such a major break occur, the gas pipeline will probably be rather low on the list of world concerns. Furthermore, Western Europe has considerable protective measures at its disposal through dual-fired capabilities, surge and storage capacity, and emergency conservation measures. It seems reasonable to expect that, aside from the general influence of a mutual sort which builds up around agreements of this type, the specific threat of a Soviet natural gas cutoff is a low-probability event.

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[51] OECD 1981, p. 11; OECD 1981a, p. 23.

[52] OECD 1981a, p. 23.

[53] The 6 percent figure is 1980 imports from the Soviet Union divided by 1979 OECD energy use from OECD 1981, p. 11.

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CMEA OIL ACQUISITION POLICY IN THE MIDDLE EAST AND THE GULF: THE SEARCH FOR ECONOMIC AND POLITICAL STRATEGIES*

By Jonathan P. Stern**

CONTENTS

	Page
Introduction	414
Oil and CMEA Relations with the Middle East and the gulf	416
The USSR	416
Eastern Europe	418
The prospects for the 1980's	419
Economic and political relations	419
The Soviet invasion of Afghanistan	420
The Iranian revolution and the Iran-Iraq war	420
Other regional actors	424
Political and military strategies	425
Watching and waiting	425
Military intervention	426
Low level intervention	427
Conclusion	428

TABLES

1. Estimates of East European oil import requirements from the world market ... 415
2. Soviet trade in oil with selected Middle East countries ... 417
3. Soviet trade with selected Middle East countries ... 417
4. Middle East exports of crude oil to Eastern Europe ... 419

INTRODUCTION

After five years of controversy and debate on the subject of CMEA*** energy problems and prospects, the basic elements of the situation would seem to be the following:

1. Whatever may happen to Soviet oil and energy production in the medium to long term, the current situation is one of self-sufficiency plus a substantial, although (in the case of oil) dwindling, margin for export.

2. The current situation in Eastern Europe is such that energy, specifically oil, constaints have become exceedingly serious and are likely to become more so in the future. These constraints are directly related to the reduced availability and increased prices of oil from the USSR and are an important component of the severe economic recession which is affecting the entire region.

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* This is an abbreviated and updated version of the author's, "Soviet and East European Relations With the Energy Heartland." In Energy and Soviet Policy, Joint Economic Committee, June 11, 1981. pp. 55–83.

** London representative, Conant and Associates, Ltd.

*** Unless otherwise stated, CMEA refers only to the six East European members of the Council for Mutual Economic Assistance plus the USSR.

3. CMEA purchases of world market oil in the period up to 1990, will not, therefor, be required for the USSR but for its allies, particularly the East European countries. Thus Soviet moves in oil producing countries which are directly observed to be related to the acquisition of oil, are on behalf of allies (although they could also be aimed at freeing up increased quantities of Soviet oil for hard currency earnings).

Table 1 offers some scenarios of East European oil import requirements from the world market over the next decade. While there are some differences in the estimates, one might summarise them by saying that although, in the event of rapid economic growth throughout the region, it would be possible to envisage a requirement of more than 100 mt of oil in the late 1980's, a realistic estimate of the quantity which will be essential to maintain a "minimum acceptable rate of economic growth and standard of living" would be around 50 mt. Although expert opinion is deeply divided over the future development of world market oil prices, if we take a figure of $30 per barrel (slightly below the current world price), an annual import of 50 mt would imply a revenue requirement of $11 billion per year. It is not possible for these countries to generate such large additional volumes of hard currency with exports to the West. Likewise, at mid-1982, with an unresolved debt crisis in Poland and a similar crisis in Romania (albeit of a lesser magnitude) and strained situations in the GDR and Hungary, one could not possibly imagine East European countries raising a fraction of this requirement in hard currency credits.

TABLE 1.—ESTIMATES OF EAST EUROPEAN OIL IMPORT REQUIREMENTS FROM THE WORLD MARKET

[Million tons]

	1985			1990		
	High	Medium	Low	High	Medium	Low
1.	125–175	50			125–175	
2.	70.5	33.5	−10	137	88.5	−12.5
3.	61.5	44.2	26.8			
4.	59	50	32	125–150	50	50
5.		30	20			

Sources:

1. CIA estimates: High estimates inferred from The International Energy Situation: Outlook to 1985. April 1977; medium and 1990 estimates inferred from reports of CIA 1981 analaysis, viz. Gordon B. Smith, "CIA Views on Soviet Oil: Risky." New York Times, July 13, 1981.
2. Office of Technology Assessment, Technology and Soviet Energy Availability. Table 74, p. 306 (The two low scenarios appear as positive figures in the source, but this appears to be a printing error as the additions indicate negative values).
3. Jan Vanous, "Eastern European and Soviet Fuel Trade," in East European Economic Assessment, Volume 2, Joint Economic Committee, U.S. Congress, July 10, 1981, Table 15, p. 558.
4. Jonathan P. Stern, "Western Forecasts of Soviet and East European Energy over the Next Two Decades," in Energy in Soviet Policy, Joint Economic Committee, U.S. Congress, June 11, 1981.
5. Jeremy Russell "Energy in the Soviet Union," Problems for Comecon?" The World Economy, Vol. IV, No. 3, September 1981.

The other means by which Eastern Europe has acquired world market oil is in direct trade with OPEC countries, mostly on non-hard currency terms. Oeschler and Martens have pointed out that prior to 1973/4 it was relatively easy for East European countries to cover their imports of crude oil in this way, with exports of manufactured goods and agricultural products. After 1973, all East European countries went through an adjustment process where deficits were incurred. By the late 1970's, all countries except Romania (where calculations are affected by the transit refining element in oil trade) appeared to have controlled their deficits, but more recent data would be likely to show that the 1978/79 oil price rises reversed this trend. Oeschler and Martens concluded that: ". . . OPEC price rises will severely affect all the East European trade balances with OPEC. For some (Romania, Poland) huge deficits will be incurred during 1980. For others, (Bulgaria, GDR) oil imports are unlikely to be matched by increased exports to OPEC. For still others, (Czechoslovakia, Hungary) barring decreases in Soviet energy supplies, exports to OPEC may possibly cover imports of OPEC oil, but only by a relatively small margin. We conclude therefore, that during the 1970's, trade with OPEC has provided a viable means for East European countries to supplement their energy supplies without having to draw down scarce hard currency reserves. It is questionable, however, whether Eastern Europe can continue to rely on this strategy." [1]

This rapid summation of the Soviet and East European oil and energy situation—granted a number of oversimplified generalisations—suggests that Eastern Europe will be requiring a significant quantity of oil (around 50 mt annually) by the mid-1980's, but will not possess the hard currency to purchase these volumes on a normal commercial basis. Failure to acquire these volumes of oil may result in severely adverse consequences for economic growth rates, but this may be the most likely "solution" to the problem. However, such a prospect must be extremely unpalatable to political leaderships throughout the region and there is already a strong and growing urgency to devise economic and political strategies for acquisition of world market oil on non-hard currency terms. It is the development of these strategies, particularly with regard to the Middle East and the Gulf, which forms the focus of this paper.

OIL AND CMEA RELATIONS WITH THE MIDDLE EAST AND THE GULF

THE USSR

The CIA was not the first source to suggest that the Soviets would need to enter the world market for oil in the 1980's. In 1967, the Polich analyst Stanislas Albinowski forecast that by 1980, the CMEA countries would find themselves in deficit by as much as 100 mt.[2] Since that time, western commentators have periodically addressed themselves to the issue of oil as one strand of Soviet policy in the Middle East.[3]

Notwithstanding these observations, the primarily "ideological" orientation of Soviet policy toward the Middle East resulted in a concentration of Soviet interest in Egypt and Syria—countries with only a modest resource base. While the Soviets made efforts to expand ties with Algeria, Libya and Iraq, only in the latter case did oil play a significant role in the relationship and formed payment for Soviet deliveries of aid, equipment, and expertise. As table 2 shows, apart from the deliveries from Iraq, the USSR exported almost as much oil as it imported in the period up to 1976 (when oil trade statistics ceased being published in volume terms).[4]

NOTE.—See footnotes at end of paper.

TABLE 2.--SOVIET TRADE IN OIL WITH SELECTED MIDDLE EAST COUNTRIES

[In thousands of tons]

	Exports				Imports			
	1973	1974	1975	1976	1973	1974	1975	1976
Afghanistan	165	193	149	149				
Egypt	352	229	231	226	209	172	211	154
Syria	36	51	2	385	247	330		450
Algeria							948	
Iraq					11,101	3,888	5,304	5,821
Libya					1,713			
Morocco	943	647	649	665				
Total	1,496	1,120	1,031	1,425	13,179	4,390	6,499	6,425

Source: Vneshnyaya Torgovlya SSSR for the respective years.

Table 3 shows that the Soviets have not established any kind of trading relationship with important oil producers such as Saudi Arabia, Kuwait and UAE. On an economic level this is not surprising; the USSR has not needed oil and these countries have not sought Soviet goods (with the exception of arms sales discussed below). Relations with Iran blossomed in the later years of the Shah's reign, largely due to Iranian gas exports to the southern republics of the USSR, which commenced in 1970.

TABLE 3.—SOVIET TRADE WITH SELECTED MIDDLE EAST COUNTRIES [1]

[Millions of rubles]

	Exports				Imports			
	1973	1976	1979	1980	1973	1976	1979	1980
Algeria	64.7	131.4	82.1	92.6	52.1	58.9	34.2	62.5
Iran	137.3	217.9	272.1	259.2	139.6	226.7	136.9	75.4
Iraq	141.5	341.6	853.7	473.2	90.6	372.9	328.2	258.5
Kuwait	7.9	10.1	7.4	15.2				
Libya	14.1	16.2	157.4	163.4	30.4		280.2	287.5
Saudi Arabia	2.9	13.2	24.5	30.8				
United Arab Emirates		4.6						

[1] These figures exclude arms sales almost totally and their inclusion would make, particularly the Iraqi and Libyan figures very different.

Source: Vneshnyaya Torgovlya SSSR for respective years.

A fuller and more political explanation of this lack of trade (and in some cases even diplomatic relations) with major OPEC countries, would take many pages, but the antipathy of Muslim ruling families to the atheistic tenets of communism and a widely held fear of Soviet expanionism, are important factors.[5] In addition, the overwhelmingly pro-western orientation of Saudi Arabia, Kuwait and the UAE, bolstered by the presence of western oil companies, enhanced anti-Soviet feelings and further excluded Soviet influence. However, with the fall of traditional leaderships and their replacement by more radical, and anti-western, regimes, the USSR succeeded in gaining a foothold first in Iraq and then in Libya.

The Baath Party, which came to power in Iraq in 1968, began a program of indigenous oil technology development for the Iraq National Oil Company (INOC) as a prelude to nationalising the western interests in the Iraq Petroleum Co. (IPC). Unsurprisingly, given the ideological bias of the Baath and the fact that the measures were ultimately aimed at displacing western companies, INOC concluded agreements with the USSR and Hungary for the exploitation of the North Rumailah oil field. Payments for equipment, technology and know-how were to be in crude oil.[6]

Perhaps it was a coincidence that the start of drilling in the North Rumailah field coincided with the nationalisation of IPC interests. A number of commentators concluded that the nationalisation was a direct result of Soviet pressure.[7] Majid Khadduri, in an interview with Saddam Hussein, notes that the Baath Party had considered nationalisation for some time, even before acceding to power and although, "The Soviet Union had been consulted on the matter (and) agreed to nationalisation in principle (it) seems to have given Iraq no encouragement in the drive to nationalise western oil operations."[8] The Soviet Union claimed that the Friendship Treaty between the two countries had made the nationalisation possible. Whether or not this was true, the result was more Soviet and East European involvement in the industry, with further payments in crude oil for equipment and technology supplied by the communist countries.

Despite frequent Soviet advances from the time of his accession to power in 1970, the wild swings in Colonel Qaddafi's foreign policy, with its periodic violently anti-Soviet interludes, did not make for an easy relationship. The breakthrough came in 1974 when Prime Minister Jalloud concluded an oil export deal in exchange for Soviet SAM missiles. Since that date, the USSR has maintained a very considerable export of hardware for the Libyan army, navy and airforce, deliveries of which were apparently running at around $350m per annum in the mid-1970's.[9]

EASTERN EUROPE

Following his 1974 trip to Moscow, Major Jalloud continued on through Eastern Europe where he signed oil agreements with Hungary, Romania and Czechoslovakia.[10] East European countries were also successful in obtaining oil from Iran. All countries, but particularly Romania, had been importing substantial quantities of oil under preferential agreements up until the fall of the Shah. Iran had also provided finance and promised oil supplies, for the Adria pipeline which was to have been the major source of world market oil for Czechoslovkia and Hungary (as well as Yugoslavia) in the 1980's.[11] The Iranian revolution completely changed the outlook for East European oil trade with Iran and we shall return to this subject below.

Table 4 shows the origin of East European oil imports from the world market and the heavy concentration on Iran, Iraq and Libya is immediately evident. Apart from Romania, where well-developed links with oil exporting countries have led to trade with all the countries listed in the table plus Saudi Arabia, the oil trading links between East European CMEA members and OPEC countries have been somewhat piecemeal and fragmented. It remains to be seen whether these countres will succeed in establishing more stable oil importing relations with Middle East countries in the future.

TABLE 4.—MIDDLE EAST EXPORTS OF CRUDE OIL TO EASTERN EUROPE [1]

[Thousand tons]

	Algeria	Iran	Iraq	Libya	Kuwait	United Arab Emirates	Total
1970	740	1,200	425	6			2,425
1971	1,055	3,395	675	550			5,675
1972	1,185	5,145	5,265	3,295			14,890
1973	410	6,630	10,380	3,890	160		21,470
1974	890	4,620	7,070	465			13,045
1975	935	2,425	8,320	1,225	1,640	705	15,250
1976	435	3,955	11,145	2,710	1,575	1,040	20,860
1977	180	5,870	10,285	1,365	1,300	1,040	20,040
1978	1,045	3,635	10,565	2,515	1,140	835	19,735
1979	640	3,185	15,540	3,290	5	995	23,695
1980	450	485	12,150	2,500	560	855	17,000

[1] These figures probably include Yugoslavia.

Source: OPEC Yearbook, 1980, pp. XXX1V–XL1V.

THE PROSPECTS FOR THE 1980's

ECONOMIC AND POLITICAL RELATIONS

When considering the outlook for Soviet trade and relations with Middle East countries in the 1980's, it is interesting to speculate on the comments one might have made if the time of writing had been ten years ago, at the outset of the 1970's. At that time one might have observed the tremendous progress that the Soviets had made in the region over the previous decade: the alliances with Egypt (then, and arguably still, the most important country in the Arab world), Syria, Iraq and to a less extent Libya and Algeria. Also the improvement of Soviet relations with Iran after a prolonged period of hostility and the establishment of a long term energy link (in the form of natural gas) with that country.[12]

In 1970 therefore, it would have been a fair judgement to predict ever-increasing Soviet presence and influence in the region, coupled with improved access to Middle East oil for CMEA countries. In the event, the following decade saw the opposite development in Egypt and Iraq, and it is still too early to comment decisively on the Iranian situation. While Soviet influence grew in the peripheral, non-oil producing countries in the region, these were poor substitutes for countries where influence was lost and did nothing to directly enhance Soviet access to oil.

One of the most important consequences of the CIA's 1977 prognosis on Soviet oil production and imports, was that it provided additional evidence for hawkish commentators, in support of their view of Soviet intentions towards the Middle East. In this view, all Soviet activities in the region are regarded as part of a master plan to take over the Gulf and its oil resources; any problems that the West is having in the region and any changes in the political status quo to the detriment of western interests, serve as "proof" of the existence and success of such a Soviet master plan.[13] The time frame of 1985, by which CMEA countries were predicted to be importing 3½–4½ million barrels per day, added urgency to the perceived Soviet desire to obtain domination over the region.[14] The

1980's commenced with an event which appeared to bear out this view.

The Soviet invasion of Afghanistan

Two and one-half years after the Soviet invasion of Afghanistan the enormity of this blunder is now apparent. Quite apart from the tragedy visited upon the people and the country, the Soviets have unaccountably failed to subdue the dissident forces in the country despite using the most modern weaponry. There are those who believe that the Soviet action in Afghanistan is the beginning of a long term strategy to take over the Gulf and its oil. While this author sees Soviet action as primarily defensive rather than offensive, it cannot be denied that the invasion brought the Soviets nearer to the Gulf and the Indian Ocean (as well as greatly extending their "border" with Iran), thereby improving their chances of realising a long term goal of a warm water port in the region. As such, it could be argued that the USSR is in a better position to cut the flow of Middle East oil to the West. If, however, the intention of the Kremlin was to extend their influence in the Gulf region and open up the possibility for further territorial expansion, this act of aggression was certainly a poor first move.

In a regional context, Soviet actions proved counter-productive, giving the USSR the image of "oppressors of Islam", a tag with enormously adverse consequences for their relations with countries in (and beyond) the region, including most of the major oil exporters.[15] Up to the time of the invasion, the Iranian accusations of U.S. aggression and imperialism had somewhat pushed the Soviet threat into the background. The events in Afghanistan caused a rethink in (or at least acted as a reminder to) those countries which relied on the U.S. as the ultimate guarantor against Soviet military action. Furthermore, Soviet action seemed to bear out all the warnings that Washington and Peking had been giving regional countries about Soviet intentions towards their territories.

In conclusion, so far from gaining economic advantage and political influence as a result of the invasion, the Soviets have lost both and incurred both regional and worldwide opprobrium. While the Kremlin has retained Afghanistan as a buffer state on its southern border, the price in military resources and human life has been far from negligible. The annexation of the country (a task which does not seem to be within the compass of the Soviet force presently in occupation) would simply add an economically backward, viciously anti-Soviet unit to a country which already has its share of regional problems. In all, the Soviets must be wishing that they could return to the status quo ante the invasion when they enjoyed near-total dominance of the country's economic and military development at a fairly small cost. It is not clear whether and how they can regain this position.

The Iranian revolution and the Iran-Iraq war

The role of the USSR in the Iranian revolution is far from clear, but little direct evidence exists to suggest that the Soviets played any part in the Shah's downfall, over and above the customary propaganda and finance in support of the Tudeh party which had continued throughout the 1960's and 1970's.[16] In the end, the Soviets must have felt equivocal about the Shah's regime. On the one hand, Moscow had gained little influence in Tehran and did not seem likely to do so while the Shah remained in power. On the other hand, useful economic and energy trade links had been set up which were very profitable for the CMEA countries.

In the event, the energy arrangements were the first casualties of the revolution. The cessation of gas deliveries (through the IGAT 1 pipeline) to the USSR, caused considerable suffering in Armenia, Azerbaijan and Georgia in the particularly severe winter of 1978/79.[17] Although supplies resumed in mid-1979, they never regained former levels and ceased entirely in March 1980 with the Soviets refusing to pay the Iranian price of five times the previous rate. As of mid-1982, no resumption of deliveries has occurred and it is not clear whether this could occur immediately because of possible damage to the pipelines and installations as a result of the war with Iraq. The trilateral IGAT 2 gas project involving the USSR and West European countries (which had been due to commence in 1981) was another early casualty of the revolution.

In the case of Iranian oil supplies to Eastern Europe, the situation is rather more complex. As table 4 shows, one of the first acts of the Khomeini Government was to cut oil exports to Eastern Europe which fell to less than half a million tons in 1980 from approximately 3.2 mt in the previous year. However, Iranian economic relations with CMEA countries began to improve rapidly as western sanctions denied the country access to goods and services which were essential for the operation of vital industries and the completion of unfinished projects. In the course of 1980, reports suggested that CMEA countries were offering to complete some of the large industrial projects which had been abandoned by western companies.[18] Among the projects which CMEA countries offered to take over were the Bandar Khomeini (formerly Shahpur) petrochemical complex and the supply of spare parts to the Iranian oil industry. The latter would have been a real coup for the Soviets, for it would have given them direct access and perhaps some measure of control over Iranian oil production. However, available evidence suggests that the Iranians always appeared keener to find ways of circumventing the embargo, rather than entrust their oil industry to the Soviet Union.[19]

Nevertheless, commercial ties between the Islamic Republic and the CMEA countries are booming as never before with one report citing a threefold increase in CMEA imports from Iran compared with the pre-revolution level. Much of this increase is accounted for by CMEA imports of 10.65 mt of Iranian oil in 1981 (2.5 mt for the USSR and 8.15 mt for Eastern Europe).[20] Twenty percent of all Iranian imports pass into the country via the Soviet border (compared with 6 percent before the revolution) which, since the outbreak of war with Iraq, has become the most secure trade route for the country.[21] 1982 is likely to be another good year for CMEA oil imports from Iran; Romania has already signed up for a minimum of 4 mt (up from 3.3 mt in 1981) and other countries can be expected to maintain their purchases as long as they can barter goods and services for incremental oil supplies.[22]

With a continuing Iranian need for industrial goods (not necessarily of high quality) and a shortage of revenues caused by a soft world oil market, there seems no reason why CMEA oil imports from Iran should not continue to expand, at least in the short term. However, there is no guarantee as to the long term security of Iranian oil supplies to CMEA countries, particularly if there should be a change in regime in Tehran. With respect to the gas trade with the USSR, it is a little surprising that a price agreement has not been concluded and one might expect this development in the future, particularly since the USSR is becoming involved in power station construction (involving gas supply logistics). However, the USSR is now in a strong position to dictate terms on a gas agreement since it has provided the logistics for supplying its southern republics and may not wish to expose those consumers once again to the risk of severance of supplies, unless the profit margin is very attractive.

If the rapprochement between Moscow and Tehran—at least at the commercial level—has been startling, the deterioration of Soviet relations with Iraq has been equally dramatic. In the 1970's, Iraq was a country both physically and intellectually inaccessible to the West. The actions and policies of the Baath regime appeared as unintelligible as they were often brutal and along with the onetime strongly pro-Soviet stance of the Baathists, these developments led conventional wisdom to label the country as a Soviet client state. Careful study of the Soviet relationship with Iraq suggests that economic and political relations deteriorated steadily in the latter part of the 1970's, mainly on account of the Iraqi desires to distance itself from Soviet policy and the regime's repressive measures against the Iraqi communist party. The elevation of Saddam Hussein to President in late 1979, if anything, intensified the anti-Soviet stance of the regime. A U.S. expert draws the following conclusions in evaluating Soviet policy towards Iraq in the 1968–79 period. ". . . Soviet influence with the elite ruling Iraq is very limited indeed . . . the USSR has been singularly ineffective with the Iraqis on matters of significance to Iraq . . . In addition, as Iraq began to project itself as the leader of the Arab World, its anti-Communist domestic policy began to take on overtones of an anti-Soviet foreign policy . . . All in all, the course of Iraqi-Soviet relations in the 1968–79 period indicates the low level of Soviet influence . . . which has given relatively little in the way of political obedience in return for a large amount of Soviet economic and military assistance." [23]

The Iran-Iraq war (which appeared to take Moscow as much by surprise as it did western capitals) highlighted these shifting alliances. The crystallisation of new regional alignments as a result of the war saw Iran, Syria and Libya (and to a lesser extent Algeria) arrayed against Iraq, Saudi Arabia, Jordan and Kuwait, and made the Soviet position very complicated. Two weeks into the war, the Soviets concluded a Treaty of Friendship and Cooperation with Syria. This action, combined with relations with North Africa (as opposed to its relative lack of contact with Iraq's allies), seemed to bring Moscow down firmly on the Iranian side of the conflict. This impression was reinforced by two (unconfirmed) Soviet offers of arms to Iran, in August and again two weeks into the fighting in October. Both were said to have been refused with the Iranian line that the Soviets should cease supplying arms to Iraq.[24]

In any event, Moscow appears to have implemented just such action, with fragmented reports suggesting that while arms and ammunition shipments to Iraq may not have been totally suspended, they were not escalated in line with the requirements of a war situation. There was no decisive boost in Soviet arms deliveries to Iraq until the Israeli attack on the Osirak nuclear reactor in July 1981.[25] Some part of Iraq's poor performance in the war may therefore be directly due to the refusal of the USSR to continue its role as arms supplier.

Given that the bulk of CMEA oil imports from the world market have come from Iran and Iraq, the future development of the war and the internal political events in both countries, which will follow a cessation of hostilities, will be very important for CMEA oil trade prospects. Short to medium term prospects for CMEA countries rest on economic considerations and the opportunities which the war may provide for large scale Soviet and East European involvement in (particularly oil) construction projects in both countries. In addition, both countries will be seeking to restore their defence capabilities and this may also present commercial opportunities. But perhaps the most important factor will rest with the state of the world oil market and oil prices. The revenue requirements of both these countries to restore their economies and development programs mean that they will be looking to maximise their oil sales in the immediate future. If world oil markets become tight and spot prices rise significantly, it will be difficult for CMEA countries to expand, or even hold, their share of imports from these countries. If however, as many predict, world oil markets stay soft and prices fall in real (and perhaps absolute) terms over the next few years, both Iran and Iraq may well find it an attractive option to export oil to Eastern Europe.

The political relations between Moscow and the belligerents will have an important bearing on the progress of oil trading links. The Kremlin certainly knows that in the short term, the animosity between the two countries means that an unpleasant choice will need to be made in terms of political and military support. This will be exactly what Moscow is trying to avoid, particularly if changes in leadership are in the offing. The best of all outcomes for the USSR would be the protracted destabilisation and radicalisation of both countries. The Soviets would also like to see the breach between Iraq and Syria—the two regional countries with which it has Treaties of Friendship and Cooperation—healed, but it must know that its own influence in this process will be extremely limited, as it has been over the past decade. If the CMEA countries (led by initiatives from the USSR) could cement a large scale commercial relationship with Iran (preferably without Khomeini) and at the same time persuade an economically weakened and politically destabilised Iraq (preferably without Saddam Hussein) to come to a truce with Iran and Syria, then the Soviets would have scored a decisive success in the region.

The most difficult judgement concerns Soviet long term political prospects in Iran and Iraq, particularly given the possibilities of imminent demise of both leaders through age and military/political defeat. While these prospects involve much larger considerations of the political future of both countries, one might observe that the Soviets are in an ideal position to profit politically from the destabilisation caused by the past twenty months of hostilities. Hard information is scanty, but suggests that the Tudeh party has made some progress in advising the leadership to turn to the USSR for assistance, despite having its share of victims in the successive waves of summary trials and executions which have taken place under Islamic rule.[26] Moscow's political prospects in both countries may depend critically on their continued and protracted isolation from the West. If Iraq continues to rely on Soviet weaponry and Iran fails to find military supplies in the West, then both countries may be equipped by the USSR. This could be an extremely positive development for Soviet influence in the region. However, it is difficult to see how Moscow can build up relations simultaneously with Iran and Iraq, particularly if hostilities and territorial incursions continue. If the USSR is forced to make a choice between the belligerents, this would place it in a very difficult position. Above all, it will not want to end up on the losing side of the conflict.

Other regional actors

Another important current and potential source of oil for CMEA countries is Libya, where the regime of Colonel Qaddafi has proved amenable to large Soviet construction and technology projects, such as the building of nuclear power stations. However, the main rationale of the Libyan-Soviet relationship, at least as far as Tripoli is concerned, must be arms sales. Given Qaddafi's preoccupation with building up a store of weaponry both larger and more advanced than his armed forces can handle and the fact that only a small part of this can be supplied by Western Europe with no possibility of any contact with the U.S., the Soviets remain extremely important to him and Libya must be a key part of any prospective CMEA oil import strategy.[27] The main problem, given the unpredictability of the Colonel, is the durability of any favourable policy towards the CMEA countries and/or any oil supplies which may be part of such a policy. It could be argued that Qaddafi shares some kind of common ideology with the USSR, but this can only be identified in terms of anti-Westernism, and especially anti-Americanism (which in the Colonel's case is bound up with hostility towards Israel). Qaddafi has passed through some violently anti-Soviet phases, however, on account of his profound Islamic beliefs and consequent hatred of Soviet atheism.

Another important problem in the future development of Libyan and Algerian exports of oil to CMEA countries (Algeria has periodically exported small quantities of oil to Eastern Europe), is that neither country is expected to expand production very greatly in the 1980's and Algerian production will actually fall. Additionally, these two countries have always been among the supreme price hawks in the OPEC group (partly because their reserves are not large) and therefore, are looking for maximum return on their oil exports which, needless to say, is hardly to be gained by exporting to CMEA. Nevertheless, if western countries were to follow the example of the U.S. in boycotting Libyan oil supplies, the country might be forced to export additional oil to CMEA countries.

Looking at other oil exporting countries in the region, it is more than four decades since there have been dilpomatic relations between Moscow and Riyadh. As has been shown above, commercial relations have been kept to a minimum. However, there are periodic signs that the Saudis have a desire to come to terms with the USSR, at least to the point of establishing diplomatic ties; the most recent indication of this attitude was in late 1981.[28] It is never entirely clear how far these Saudi initiatives are a signal to the U.S. that the Kingdom has political alternatives and/or how far they reflect the attitude of one Saudi academic that, ". . . we shall have to sell oil to the Russians eventually and . . . this must mean diplomatic relations. . . ."[29] Members of the royal family, and particularly the present King, have in the past given the impression that they regard such relations as an inevitable, even if not necessarily immediate, development.[30] Kuwait has purchased limited quantities of arms from the USSR and contributed finance towards the construction of the Adria pipeline. In addition Kuwait's leader completed a tour of East European states in the Fall of 1981, by saying that he would urge the conservative Gulf monarchies to establish diplomatic relations with the USSR and East European countries.[31] The United Arab Emirates has shown some interest in commencing meaningful trade relations with East European countries.[32]

POLITICAL AND MILITARY STRATEGIES

The USSR has at its disposal a range of policies from near total isolationism to massive military intervention in the Middle East. However, it seems appropriate to consider three major options for Soviet oil acquisition in the Middle East:

Watching and waiting

While it is unlikely that the USSR will remain aloof from developments in a region where, by any objective standards, it has vital national security interests, it can afford (with respect to energy supplies) to allow events to take their course in the Gulf and act to promote its interests as it sees fit. Political turmoil in the region is the rule rather than the exception, to the point where the absence of some kind of regional conflict for any long period of time is inconceivable.

This does not have to be an event with as much significance as the Iranian revolution; indeed it need not involve any drastic regime change. The constantly shifting regional alliances (causing changes in relations with the West) may give the USSR opportunities to select courses of action which involve comparatively little cost or risk to itself. This is because, in marked contrast to western countries (particularly Western Europe and Japan) the USSR is not dependent on Middle East oil. As Andreyasan has noted, "The Soviet Union produces enough oil to be independent of the import of this expensive raw material. This is one of the major factors of our strategic invulnerability." [33] However, if East European countries become dependent on oil deliveries from specific Middle East countries to a significant extent, this may restrict Soviet flexibility and capacity to react to regional events. In addition, opportunity must be backed by discretion in action; as has been discussed above, the Soviets have to make the correct choices in conflicts such as the Iran-Iraq dispute, otherwise they will risk alienating the partners and losing any investment they have made. In this regard, the shift of support from Somalia to Ethiopia must be fairly fresh in the mind.

Military intervention

This could take two forms: the use of military force to control "choke points" and vital sea lanes in order to interdict western supplies of oil; and the invasion of oil producing countries followed by the takeover of installations. It has been suggested that there is a great threat from Soviet capabilities to control the vital waterways of the Strait of Hormuz and the Bab el Mandeb Strait. This concern has arisen on account of Soviet political successes in the Horn of Africa and South Yemen and the access that this may afford to the key transit routes through which all Middle East oil must pass.

Despite this concern, it must be said that there is no evidence that the USSR has sought to directly halt the flow of oil supplies to the West. During the 1973 oil crisis the Soviets helped to ameliorate the situation for the West, albeit at considerable profit to themselves. The Iraqis were greatly angered by Soviet reselling of their oil (which had been purchased at pre-embargo prices) to Western Europe at prices above world levels.[34] This was the action of a country aiming to make a rapid profit, but not of one wishing to add to western misfortune. Nevertheless, it would be naive to suggest that the USSR has not taken account of the West's vulnerability to interruptions in, or even simple uncertainties surrounding, the flow of Middle East oil and this is an area where pressure may be applied. Having said that, the Soviets are well aware of the stakes, as evidenced by Andreyasan's statement that, "it is well realised in the USSR that a serious violation of oil deliveries to the West from the Gulf region is fraught with a sharp aggravation of international tension and can bring the countries concerned to the brink of military conflicts which, in view of the great role played by the region in world affairs, could go beyond the local bounds and pose a threat to world peace." [35] Similarly, the Soviet Union cannot fail to realise the seriousness of any major invasion of an oil producing country and the reaction that this would engender in the West. If the invasion of Afghanistan was meant as a trial run (which is not thought likely by this author), the U.S. response of the Carter Doctrine and the creation of the Rapid Deployment Force should have made the position perfectly clear.[36] In addition, the prospects for Soviet success in taking over a Middle East country with its oil facilities intact is by no means assured. As Dunn has pointed out, the USSR may hold some strategic advantage but there are important limitations on its capacity to fight a war (as the conflict in Afghanistan has demonstrated only too clearly).[37] When one looks at the prospect of deliberate Soviet military action at a high level of visibility, it seems unlikely that Moscow would take the risk of engaging the other Superpower in a conflict which could escalate rapidly, simply to fulfill the energy needs of its allies in Eastern Europe.[38] There might be other reasons for Soviet military moves in the Gulf region, but the energy imperative is nowhere near great enough to justify the risks involved.

Low level intervention

Somewhere in between options 1 and 2 (and closer to the way in which a consensus of studies would actually characterise Soviet policy over the past two decades), one could see the USSR taking positive steps to hasten the kind of progress, in terms of regime changes, that they wish to see in the region. This kind of low level intervention would be characterised by judicious financial and military suport for dissident groups within countries where domestic political instability may give these groups the opportunity to attain power. The hallmarks of this policy in the future will be, as in the past, ". . . adaptability, persistence and pragmatism as well as opportunism and low risk."[39] The difference will be that in the 1980's, such policy will need to include a strategy for securing access to oil supplies.

One way in which this can be achieved is to exploit instability in oil exporting countries and the potential for Soviet action aimed at destablising Iran and Iraq is currently very great. The emergence of Soviet capability to promote instability in the region (by non-military means) will be extremely important and will apply to a wider strategic threat connecting the peripheral countries—Afghanistan, Turkey, the Yemens, the Horn of Africa—to the oil producers, particularly the conservative monarchies. The possibility of diplomatic relations between the USSR and Saudi Arabia may be viewed in Riyadh as a necessary "insurance policy", in the face of declining U.S. power and presence in the region and increasing Soviet presence. This would allow the Saudi monarchy to open up a channel of communication with Moscow, while continuing to keep its distance from the political and philosophical tenets of Marxism.

Such a channel may be important in the future if, as has been suggested here, oil becomes a more important element in Soviet strategy toward the region. An approach might come from either side: Moscow in search of oil supplies for its allies on concessionary terms; Riyadh in search of an understanding with the USSR on regional security and restraint in Soviet policy. Thus one might envisage an arrangement by which the Kingdom would make 25 mt of oil available annually on concessionary terms (a quantity which, given Saudi oil reserves, current surplus capacity and financial strength would scarcely cause a ripple throughout the economy), in return for a Soviet commitment to regional stability and an undertaking to control its regional allies. This could be an immensely profitable arrangement for both sides. There would be the added advantage that if the Soviets were to break their undertaking, the flow of such oil could be immediately halted, causing hardship to East European countries; thus there would be leverage from the Saudi side.

The problem with this arrangement is that it would drastically curtail Soviet low level intervention activities, which have been characterised here as their most effective policy instrument in the region. Such an arrangement may also overrate the influence which the Soviets can exert over their regional allies. However, this analysis does suggest that from an oil acquisition perspective, the USSR may have to choose between a stable region with minimal Soviet interference and a stable oil import relationship with a major producer, and an unstable region offering opportunities to support and perhaps install pro-Soviet regimes, but with little immediate access to oil.

CONCLUSION

In the absence of a major change of political orientation (such as occurred in Iran) in one of the key oil producing monarchies in the Arabian Peninsula, Soviet and East European oil purchases from the world market will remain concentrated on Iran, Iraq and Libya. The changing political landscape within and between Iran and Iraq will afford the Soviets certain opportunities to gain political influence and expand their exports to these countries, particularly in the military sector. These developments may, in time, bring expanded access to oil supplies.

However, there is no certainty in any of these predictions and no guarantee of stability for any oil trading relationships which may be established. There is no sign that CMEA countries will be successful in persuading oil exporting countries to part with significant quantities of oil (i.e. a total of 50 mt which Eastern Europe may require annually by the mid to late 1980's) over a period of years, on anything other than hard currency terms. If this conclusion is correct, there is a possibility that the USSR will consider military and political options for the acquisition of Middle East oil.

Of the options open to the USSR in its conduct of Middle East policy a watching and waiting policy is possible, but probably underrates Soviet desires and abilities to influence events to its advantage. A policy of military intervention is unlikely, partly because of the risk of escalation of such action, both within the region and with the other Superpower, but mainly because it is difficult to believe that the Soviets would take military risks simply on behalf of its allies in Eastern Europe. One has constantly to remember that, logistical arrangements aside, all CMEA oil imports from the world market through the 1980's (and probably beyond) will be required for East European countries rather than for the USSR. The most likely Soviet policy is one of intervention at a low level which can be raised progressively if the situation is deemed to warrant such action.

Soviet low level intervention is likely to be concentrated on Iran, Iraq and Libya. The reasons for selecting these three countries are that: they are oil producing countries where the potential for substantial political instability is marked; they have anti-western (specifically anti-American) regimes, such that if discernibly pro-Soviet elements were to appear in the Government, there would be little that the West could do about this; oil production from any one of these countries would comfortably see the CMEA through the next two decades. This is not to say that the Kremlin does not wish, and will not try to promote instability in Kuwait or Saudi Arabia, but with entrenched western interests in these countries and pro-western regimes which are super-sensitive to communist threat, such moves would greatly increase the risks of confrontation with the U.S. Soviet policy towards the conservative monarchies is more likely to centre on bartering concessionary oil for guarantees of Soviet good behaviour in the region. If Soviet policy in Iran and

Iraq should fail to produce access to oil, then approaches to the Gulf monarchies could take place sooner rather than later.

FOOTNOTES

[1] Ronald G. Oeschler and Jack A. Martens, "Eastern European Trade with OPEC: A Solution to Emerging Energy Problems", in *East European Economic Assessment* Part 2, Joint Economic Committee, U.S. Congress, July 10, 1981, pp. 509–540.

[2] Albinowski in Lincoln Landis, *Politics and Oil: Moscow and the Middle East.* New York: Dunellen, 1973.

[3] Most notably: Robert E. Hunter, *The Soviet Dilemma in the Middle East: Part II Oil and the Persian Gulf,* Adelphi Paper No. 60, IISS, October 1969. Abram S. Becker, "Oil and the Persian Gulf in Soviet Policy in the 1970's," in Michael Confino and Shimon Shamier, eds. *The USSR and the Middle East.* Jerusalem: Israel University Press, 1973, pp. 173–214.

[4] Soviet "imports" of oil are not believed to touch Soviet soil but are reexported to third countries, mainly in Eastern Europe.

[5] These fears are often based on tangible memories such as, in the case of Iran, the Soviet attempt to set up "autonomous" republics in Azerbaidzhan and Kurdistan. See for example, R.K. Ramazani, "The Autonomous Republic of Azerbaidzhan and the Kurdish People's Republic: Their Rise and Fall," in ed. Thomas T. Hammond, *The Anatomy of Communist Takeovers,* Yale University Press, 1975.

[6] Majid Khadduri, *Socialist Iraq.* Washington D.C.: Middle East Institute 1978.

[7] Foy D. Kohler, Leon Goure and Mose L. Harvey, *The Soviet Union and the October 1973 Middle East War.* University of Miami, 1974, pp. 78–89.

[8] Khadduri, p. 126.

[9] Roger F. Pajak, "Arms and Oil: The Soviet-Libyan Arms Supply Relationship," *Middle East Review,* Winter 1980–81, pp. 51–56.

[10] Galia Golan, *Yom Kippur and After,* Cambridge University Press, 1977, pp. 199–200.

[11] The Adria pipeline was completed in 1980. So far, very little oil has been delivered to any of the countries by this means and this is testimony to the inability of East European countries to discover a means of purchasing oil from the world market.

[12] These are the rough conclusions reached in Hunter.

[13] A good example of this can be found in, Miles Costick, *A Perspective on the Pressures Behind Soviet Middle Eastern Strategies.* Institute on Strategic Trade, Washington D.C. Current Analysis, No. 1, October 15, 1978.

[14] CIA, *The International Energy Situation, Outlook to 1985.* April 1977.

[15] See for example the response from the Saudi Arabian foreign minister, "A Saudi Response to Mocow," *Middle East Economic Survey* (henceforce MEES) Vol. XXIII, No. 41, July 28, 1980.

[16] Shahram Chubin, *Soviet Policy Towards Iran and the Gulf.* Adelphi Paper No. 157, esp. pp. 33–34.

[17] For a broad discussion of these events see, J.B. Hannigan and C.H. McMillan, *The Soviet Energy Stake in Afghanistan and Iran: Rationale and Risk of Natural Gas Imports.* Institute of Soviet and East European Studies, Carleton University. East-West Commercial Relations Series, Research Report No. 16. August 1981.

[18] Andrew Whitely, "Big Rise in East Bloc's Iran Sales," *Financial Times,* June 10, 1980.

[19] Simon Henderson, "Soviets Offer Tehran Spare Parts for Oil and Gas Equipment," and "Iran $63m Order Avoids U.S. Ban," *Ibid,* March 28 and July 17, 1980.

[20] Terry Povey, "Iran's Trade Shows Shift to Soviet Bloc," *Ibid,* March 10, 1982.

[21] *Ibid.*

[22] "Iran Signs Trade Agreement for 1982 with Romania," *MEES,* Vol. XXIV, No. 52. October 12, 1981.

[23] Robert O. Freedman, "Soviet Policy Towards Ba'athist Iraq," in ed. Robert H. Donaldson, *The Soviet Union in the Third World: Successes and Failures.* Boulder: Westview, 1981, pp. 186–187.

[24] Nevertheless, the Soviets have not ruled out buying arms from the USSR, President Ali Khameni affirmed in early 1982 that his country would consider purchasing Soviet weapons. Philip Marfleet, "The Love-Hate Relationship between Tehran and Moscow," *The Middle East,* April 1982, pp. 16–18.

[25] Patrick Cockburn, "Moscow to Resume Vital Arms Sales to Iraq," *Financial Times,* July 6, 1981.

[26] This author has seen no recent convincing analysis of the role and strength of the Tudeh Party in present day Iran, but see for example, "Big Brother Moves In," *Time Magazine,* November 23, 1981, p. 19.

[27] *Pajak, loc. cit.*

[28] Richard Johns, "Saudis May Establish Soviet Diplomatic Links," *Financial Times,* November 11, 1981.

[29] *Sunday Telegraph,* February 11, 1979, p. 9. Sheikh Yamani has always been convinced of the CIA view of Soviet oil and constantly warned that Moscow would be seeking oil from the Gulf.

[30] Adheed Dawisha, *Saudi Arabia's Search for Security.* Adelphi Paper No. 158. Winter 1979/80. also the interview with Crown Prince Fahd in *Middle East Economic Survey,* Vol. XXIII, No. 14, January 21, 1980.

[31] *Ibid.* Vol. XXIV, No. 50, September 28, 1981.

[32] "East Bloc Trade Offices for Gulf," *Financial Times,* January 17, 1981

[33] Ruben N. Andreyasan, "Oil and Soviet Policy," in ed. Abdel Majid Farid, *Oil and Security in the Arabian Gulf.* London: Croom Helm, 1981, pp. 57–81.

[34] Golan, pp. 197-198.

[35] Andreyasan, p. 76.

[36] President Carter, in his January 1980 State of the Union message affirmed that: "An attempt by an outside force to gain control of the Gulf region will be regarded as an assault on the vital interests of the United States. It will be repelled by any means necessary including military force."

[37] Keith A. Dunn, "Constraints on the USSR in Southest Asia: A Military Analysis," *Orbis*, Volume 25, No. 3, Fall 1981, pp. 607-629.

[38] For an analysis of Soviet unwillingness to engage the U.S. directly in the Middle East see: Francis Fukayama, "Nuclear Shadowboxing: Soviet Intervention Threats in the Middle East," *Ibid*, pp. 579-605.

[39] Alvin Z. Rubinstein, "The Soviet Union and the Arabian Peninsula," *World Today*, November 1979, pp. 442-452.

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SOVIET ENERGY POLICY

By Thane Gustafson[*]

CONTENTS

Page
I. Setting of the paper and main purposes 431
II. Dimensions of the current energy policy 432
III. Evolution of Soviet policy 1972–1982 438
IV. Issues and challenges in present energy policy 445
  Finding a sound balance between near and long term 446
  Maintaining coherence and limiting subversion 449
  Substitution among energy sources 452
V. Conclusion 455

I. SETTING OF THE PAPER AND MAIN PURPOSES

Since the end of 1978 Soviet leaders have seen themselves facing the danger of an acute energy crisis and a related collapse of hard currency earnings. They have responded with an emergency program that makes energy the country's top industrial priority. The swing of scarce resources to that sector has been so dramatic that it cramps the development of the rest of Soviet industry (particularly in the European USSR) at a time when the overall growth rate of investment resources has slowed to its lowest level in the post-war period, while simultaneously raising the chances that the energy sector may choke on such a massive flow of new funds, materials, and priority.

The focus of this chapter is on the political challenges that such a large and sudden change in course necessarily raises. We were accustomed to thinking of the late Brezhnev leadership as a stodgy and tired *fin de règne*, a regime of postponed decisions, and in many respects it was exactly that. But, faced with what it evidently regarded as a grave threat, the Kremlin under Brezhnev showed that it could respond vigorously, just as it did in defense and agriculture in the 1960's and 1970's.

But in those earlier days the Soviet leaders were younger, the economy had more slack, and the country's foreign relations were more serene. Consequently, the crash response of the last five years (and especially of the last two) is a remarkable political decision and raises a host of practical questions: What exactly is the nature of the threat that Soviet leaders believe they face? Were they slow in perceiving it and in designing a coherent response? How well thought-out is their present program, and how likely to endure and succeed? What do its main features, and the way they are being carried out, reveal about the intentions of the leaders and the choices they have made? How might the program go wrong, and in that case how might it be altered or curtailed? This chapter will address those questions first by outlining the main features of the present policy, then by recounting briefly the background of the last ten years and discussing the principal decision-making challenges of the current policy.

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II. DIMENSIONS OF THE CURRENT ENERGY POLICY

Increase in the overall priority and saliency of the energy issue, compared to the 25th Party Congress

Just how seriously the Soviet leaders viewed their energy problems in 1981 can be judged by the resources they chose to put into energy development: at a time of unprecedented stringency, in which the five-year growth target of investment was held to a record low of 11.2 percent, the Soviet leaders allocated a whopping 85.6 percent of the incremental investment in industry to the energy sector alone. The totals announced by Gosplan chairman Baibakov in November 1981 call for a 50 percent increase in energy investment, or 132 billion rubles, over five years.[1] The physical output targets for the 11th Plan are as follows:

	1980	Draft 11th plan	Final 11th plan
Oil (Mtnat)	603	620–640	630
Coal (Mtnat)	716	770–800	775
Gas (Bm^3)	435	600–640	630
Electricity (BKw-hr)	1295	1550–1600	1555
Of which hydropower (Bkw-hr)	184	230–235	230
and nuclear (Bkw-hr)	73	220–225	220

Source: 1980 data are from Narodnoe khoziaistvo SSSR v 1980g. 11th. Plan data are from Izvestiia, 18 November 1981.

The reader will note that the targets for coal and oil are relatively modest: the 1985 target for oil is essentially the same as the one that the Soviets, back in 1976, had hoped to reach by 1980; and the coal target is lower.[2] This reflects, first of all, the disappointing recent performance of those two industries: oil and coal output have failed to meet their annual plans every year since 1976.[3] But the deeper message conveyed by the five-year output targets, when set alongside the investment figures, is that the Soviets are having to invest ever-larger amounts of capital for shrinking marginal returns. "In recent years," says a high Gosplan official, "capital investment in exploration, extraction, and transportation of energy has grown 50 percent faster than energy output itself, and in the oil and gas industries 60 to 100 percent faster."[4]

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[1] Baibakov speech, Izvestiia, 18 November 1981.

[2] Initial targets for the 10th Five-Year Plan are taken from the text of the Main Guidelines, as reprinted in XXVyi, s"ezd Kommunisticheskoi partii Sovetskogo Soiuza (stenograficheskii otchet), volume 2 (Moscow: Izdatel' stvo politicheskoi literatury, 1976), pp. 226ff.

[3] See Edward A. Hewett, "Soviet Energy Prospects and their Implications for East-West Trade," (Paper prepared for delivery at the Conference on Economic Interchange with the USSR in the 1980's, April 15–17, 1982, Elkridge, Maryland; to be published in a collection edited by Abraham S. Becker, Lexington, Books, 1983.

[4] A. A. Troitskii, "Osnovnye napravleniia razvitiia toplivnoenergeticheskogo balansa elektroenergetiki strany," Teploenergetika, No. 5, 1981. pp. 2–4. This information cannot be checked

Continued

Unfortunately, many of the details on energy investment are still shrouded in mystery. No separate totals have been released for oil, coal, or electricity; and though more detailed figures are available for gas (as we shall see in a moment), they are incomplete and not entirely consistent. It is not even possible to pin down exactly what Baibakov's overall total of 132 billion includes. If the curious reader should try the experiment of multiplying by 50 percent the energy investment figures listed in the standard handbooks for the 10th. Plan, (which do not include transportation of organic fuels or oil refining) he will arrive at a total of around 100 billion rubles, which presumably represents a rough estimate of direct energy investment in those energy sources for the 11th Plan. What, then, is the additional 30-odd billion in Baibakov's energy figure slated for? Transportation? Or refining and petrochemicals? Either one would be a logical candidate, but clearly Baibakov's total does not have room for both. For that matter, any truly comprehensive energy figure would include figures for R&D for synthetic fuels and coal utilization, exploration, as well as energy conservation and interfuel substitution, so that we may be sure that the real investment cost of the Soviet energy program is higher than Baibakov's estimate. The paucity and vagueness of the investment figures given to date may simply reflect that that party leaders and top government officials themselves have not yet completely come to grips with the enormity of what their energy program is going to cost them, or how far they will need to go to meet their stated targets.

One thing that is quite clear, however, is that top priority in the Soviet program goes to natural gas. Gas was the star performer of the 10th Plan, being the only energy source that actually achieved the five-year targets set for it in 1976. In the 11th Plan, natural gas is supposed to provide 75 percent of the net addition to the fuel balance,[5] and will replace oil as the Soviets' main source of hard currency. Natural gas output is scheduled to reach 630 billion cubic meters per year by 1985, which will put the Soviet Union in first place worldwide. Siberia alone is expected to produce 356 billion m^3., 60 percent of the total Soviet output.[6]

To achieve this goal, the Soviet gas industry and the pipeline construction agencies could well spend between them over 45 billion rubles, in other words, more than half of the increment allocated to the energy sector. That is not the Soviet's own figure, because they have not published one, but one can arrive at a rough estimate from the bits and pieces available.

We look first at the record of the last three five-year plans. From 1965 to 1980 the investment budget of the gas industry grew very rapidly, from 4.05 billion rubles in the 8th Plan (1966–70) to around 21 billion in the 10th.[7] For the 11th Plan, there have been two in-

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against the statistics available in Narodnoe khoziaistvo, because the investment statistics listed there for the energy sector do not include exploration and transportation.

[5] A. A. Troitskii, "Osnovnye napravleniia. . .," op. cit. How Troitskii arrives at this figure is a little puzzling. Edward Hewett, in the article cited earlier, by converting all the Soviet energy targets to millions of barrels per day of oil equivalent (mbdoe), puts the share of natural gas at 64 percent, or 3.20 mbdoe out of 4.98.

[6] Iu. V. Zaitsev (first deputy minister of the gas industry) "S" ezd profsoiuza rabochikh neftianoi i gazovoi promyshlennosti," Stroitel' stvo truboprovodov, No. 3 (1982), p. 5.

[7] The figures for the 8th and 9th Plans come from R.D. Margulov, *Razvitie gazovoi promyshlennosti i analiz tekhniko-ekonomicheskikh pokazatelei* (Moscow: VNIIZ Gazprom, 1976), p. 17.

Continued

direct statements by top officials. At the 26th Party Congress, the late minister of gas, S.A. Orudzhev, stated that the gas industry would spend as much in the coming five-year plan as in the last three conbined, which adds up to around 36 billion rubles.[8] Six months later, after Orudzhev's death, the new gas minister, V. Dinkov, used the formula that gas investment in the 11th Plan would be double that of the 10th, i.e., around 42 billion rubles.[9] Thus, for the 20-year period from 1966 to 1985 we have the following trend:

Total investment in the Soviet gas industry (1966–85)	*Billions of current rubles*
8th Plan (1966–70)	4.05
9th Plan (1971–75)	10.90
10th Plan (1976–80)	20.7 to 21.5
11th Plan (1981–85):	
Orudzhev's formula	35.7 to 36.5
Dinkov's formula	41.4 to 43.0

About 70 percent of the total is to be devoted to pipelines,[10] much of it to build 20,000 kilometers of 56-inch pipelines from Urengoy. A Soviet rule of thumb is that the 6 56-inch pipelines from Urengoy to the West cost roughly 1 billion rubles per 1000 kilometers.[11]

However, authoritative sources also mention higher figures, particularly for pipeline investment, and this suggests that costs estimates for the gas campaign have been unsettled and may even now be surrounded by controversy. M.S. Zotov, chairman of USSR Bank for Construction, states that for the six main lines from Urengoy the planners have allocated a total of 31 billion rubles,[12] or 1.5 billion rubles per 1000 km, 50 percent more than the estimates cited earlier. Similarly, *Pravda* gives the cost of the export line as 7.6 billion rubles, which is closer to 1.7 billion rubles per 1000 km,[13] although the export line, because it uses imported compressors, is presumably somewhat more expensive than the others. The implication of both figures is that the gas campaign could require some 10 billion rubles more than the range implied by Dinkov, that is, a total somewhere above 50 billion rubles.

In sum, meeting the projected gas targets will require between 45 billion and 55 billion rubles.[14] The upper figure is possibly too higher; "but" if the Soviets really stick to their current targets (a question we shall discuss below), costs may run well above plan;

For the 10th. Plan, the late minister of the Gas Industry, S.A. Orudzhev, gave the figure 21.5 billion ("Zadachi rabotnikov gazovoi promyshlennosti na 1980 god," *Gazovaia promyshlennost', No. 2, 1980, pp. 5–6).* In both cases, incidentally, the figures include pipeline investment and lump together the categories of "productive" and "nonproductive" investment.

[8] Orudzhev's speech at the 26th Party Congress, reported in *Pravda*, March 2, 1981.

[9] V. Dinkov, "Zveno energeticheskoi programmy," *Sovietskaia Rossiia*, August 1, 1981.

[10] Statements by the Gas Minister V. Dinkov, "Gazovaia promyshlennost' na marshe piatiletki," *Ekonomicheskaia gazeta*, No. 2 (1982), p. 2, and "West Siberia's Gas," *Novoe Vremia*, No. 19 (1982), P. 19.

[11] See for example Boris Shcherbina, minister of MNGS, in *Stroitel'stvo truboprovodov*, 12-1982, p. 6.

[12] "Vazhnye zadachi finansirovaniia i kreditovaniia kapital'nogo stroitel'stva," *Finansy SSSR*, No. 4 (1982). p. 4.

[13] "Urengoy-Uzhgorod: pervaia tysiacha kilometrov," *Pravda*, October 4, 1982.

[14] One arrives at similar figures if one starts from recent statements from the gas minister that pipeline construction in Siberia will absorb 70% of the investment in the gas sector in the 11th Plan. ("Gazovaia promyshlennost' na marshe piatiletki," Ekonomicheskaia gazeta No. 2 (1982), p. 2, and Novoe Vremia, No. 19 (May 1982). A statement by TASS uses the figure 67% instead of 70 percent (FBIS, January 13, 1982).

and the gas and pipeline programs between them could absorb as much as 7 percent of the 700-billion total investment budget planned for the entire country for the first half of the 1980's. The gas campaign is clearly the centerpiece of the 11th. Five Year Plan.

Can the Soviet gas and pipeline-construction industries successfully handle such a phenomenal inflow of resources in so short a time? The demands placed on them are extraordinary: 40,000 kilometers of major new pipeline, of which 20,000 are to be laid in six 56-inch pipes from Urengoy to the European USSR.[15] Total gas production is to rise from 435Bm^3 in 1980 to 630Bm^3 in 1985, or average annual increments of nearly 40Bm^3. Tiumen' Province alone is expected to produce 330Bm^3 by 1985, up from the 1980 level of 144; in other words, nearly the entire increase in Soviet gas production must come from that province alone, indeed, from one field, Urengoy, whose output is scheduled to increase from 50Bm^3 in 1980 to between 250 and 270 by 1985.[16]

The requirement for basic materials such as pipe are equally daunting: a Soviet rule of thumb is that every 1,000 kilometers of 56-inch pipeline requires a million tons of pipe; in other words, the Soviets need 20,000,000 tons of 56-inch pipe during the 11th Plan alone.[17] If one adds to that roughly another 10 million tons of pipe for the remaining 20,000 kilometers of smaller diameter pipeline, the total requirement is about 30 million tons, or about ¼ of one year's Soviet output of rolled steel (at the planned 1985 output rate).

Even these statistics do not give a full idea of the burden that has been placed on the shoulders of the gas-field and pipeline builders, and of the logistical nightmares that result from so rapid a reallocation of resources. The Ministry of Oil and Gas Industry Construction, which had never exceeded a monthly rate of 500 kilometers of finished trunk line until 1981,[18] was assighed a target of

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[15] During the months between the adoption of the draft guidelines in February 1981 and the adoption of the final version in November, several revealing changes in the targets occurred: While the guidelines had called for 50,000 kilometers of new trunk line by 1985, by the beginning of September Pravda began to use the figure of 40,000 kilometers (Pravda, September 6, 1981), and in October the new lower figure was confirmed in Ekonomicheskaia Gazeta ("Razvitie truboprovodnogo transporta," Ekonomicheskaia Gazeta, No. 43, October 1981, pp. 1–2). At least part of the reduction concerns the large 56-inch lines leading from Western Siberia to the industrial center. Whereas earlier in the year the official intention was to build seven such lines by 1985, by the fall the figure had been reduced to six. Instead of 26,000 kilometers of 56-inch pipe, the new official target is somewhat lower, with 20,000 being devoted to the six lines (including one leading to Western Europe), and a certain unspecified additional length, possibly intended for Yamburg, to serve as a start for the 12th Plan follow-ons. (The initial figure of 26,000 kilometers appeared in "Zadachi rabotnikov . . ." [op. cit.], and was cited also in the address of Iurii Baranovskii, "Development of Gas Industry of the Soviet Union and Possibilities of Increase in Exports of Natural Gas to Western Europe." ((Unpublished paper delivered at the European Gas Conference 1981, Oslo, Norway, May 25, 1981.)) The later figures can be found in "Razvitie truboprovodnogo . . .," op. cit. The picture is clouded somewhat by the fact that a variety of figures have appeared on Soviet plans for 56-inch lines, and it is not clear how they are to be reconciled. The gas minister Dinkov, in August 1981, uses the figure 19,000 kilometers ((Dinkov, "Zveno energeticheskoi . . .," op. cit.)). A still lower figure, 16,600 kilometers, appeared in the spring of 1981 in Planovoe khoziaistvo (("Ratsional'noe ispol'zovanie material'nykh i trudovoykh resursov na stroitel'stve magistral'nykh nefte- i gazotruboprovodov," Planovoe khozoiaistvo, 4–1981, p. 50)). This figure, which comes from the Tiumen' obkom, is matched by a lower figure for gas-processing capacity than the gas minister uses.)

[16] These figures were presented by the newly-promoted first deputy minister of the gas industry, R.D. Margulov, at a meeting of the leaders of the labor unions of the oil and gas industries, 4 February 1982, as reported in "Na glavnom napravlenii," Gazovaia promyshlennost'. No. 4 (1982), p. 5.

[17] V. Lisin and V. Parfenov, "Energiia tiumenskogo severa," Pravda, May 7, 1982.

[18] Iu. P. Batalin, "Gaz Urengoia—Moskve," Sotsialisticheskaia Industriia, January 6, 1981.

8200 kilometers for 1981, an average of nearly 700 km.[19] By the end of the year it had fallen far short, although by concentrating its resources on the six major line from Urengoy, the Ministry of Construction for the Oil and Gas Industry (Minneftegazstroi) could report that the most important part of the program was on target.[20]

The main line of battle is in West Siberia, and here the increases in targets have been particularly dramatic: The head of Tiumentransgaz, the main pipeline operator in Western Siberia (which acts as the gas ministry's *zakazchik* in contracts executed by Minneftegazstroi), reports that while his organization oversaw the construction of 1,500 kilometers of trunk line in the 10th Five-Year Plan, it has been assigned a target in the 11th Plan of 7,500 kilometers, all at 56 inches and 75 atmospheres.[21] The same executive reports that while his organization absorbed 1.1 billion rubles in capital investment during the 10th Plan, he has been allocated 7.5 times as much (i.e., 8.25 billion) for the 11th.[22] However, Soviet data suggest that unit costs per kilometer of finished pipeline may be as much as twice as high in the 11th Plan as in the 10th.,[23] which raises the question whether Tiumentransgaz has been given enough capital to do the job. The builders are supposed to make up the difference through increased productivity. But initial reports on performance in 1981 suggest that the gas industry did not meet its annual plan target for productivity improvement. Unless this situation can be improved the leaders may have to spend even more to meet their gas targets.

Given these challenges, how has the gas campaign fared in its first year-and-a-half? Both gas development and pipelaying (at least the main 56-inch lines) are ahead of schedule, according to official reports. Urengoy, the centerpiece of Soviet gas strategy, reached an output level of 110 Bm^3 year in late May 1982 and is scheduled to produce a total of 120 Bm^3 in 1982,[24] 32 Bm^3 more than in 1981. Of the 20,000 kilometers of 56-inch pipe scheduled for the 11th Plan, approximately one-third had been installed by the beginning of May 1982.[25] As of August 1982 100 new compressor stations had come on line.[26] Total new compressor capacity, however, is running behind the plan: whereas the 11th. Plan calls for 25,000 megawatts of new capacity by 1985 (an annual rate of 5,000), only 2,400 megawatts were installed in 1981 and the plan for 1982 is a relatively modest 4,200 megawatts.[27]

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[19] "Zadachi rabotnikov . . . ," op. cit.

[20] Year-end report by the Minister, B. Shcherbina, published in Stroitel' stvo truboprovodov, No. 4 (1982), p. 2.

[21] E. N. Iakovlev, "Vazhnye usloviia osvoeniia regiona," Gazovaia promyshlennost', No. 4, 1981, pp. 10–11.

[22] Ibid.

[23] "Ratsional 'noe ispol 'zovanie . . . ," op. cit., p. 52. The figure given there is for an unnamed stretch of approximately 1000 kilometers in Western Siberia, quoted from a preliminary planning document submitted to Glavsibtruboprovodstroi. Whether it is representative of cost trends for all pipeline construction in Western Siberia (let alone elsewhere in the country) is another matter.

[24] Sotsialisticheskaia Industriia, 27 December 1981.

[25] Lisin and Parfenov, op, cit.

[26] "Sverim chasy," Pravda, 17 August 1982.

[27] V.A. Dinkov, "Gazovaia promyshlennost' na marshe piatilet'ki," Ekonomicheskaia gazeta, No. 2 (January 1982), p. 2.

All in all, according to one recent article, the pace of pipelaying and compressor installation must be stepped up by 2 to 2.5 times in order to meet the plan targets.[28] In addition, there is growing concern in the Soviet press about what the reliability of the hastily-assembled pipe network may prove to be. This question may come to dominate Soviet thinking by 1984 or 1985.

The challenges and stakes of the Soviet gas campaign are discussed at greater length in Edward Hewett's chapter in this volume, and we shall not deal with them further here. Their main implication, from the standpoint of the Soviet policy-maker, is that while there do exist serious bottlenecks, particularly in the pipeline program, they can be relieved if the leaders are willing to devote enough political priority and money to the task. But where does that leave the rest of the Soviet energy sector, or for that matter the rest of Soviet industry? So great is the priority already being given to gas that the other energy sources—oil, coal, and power—appear to be getting only a half of the energy investment increment to share among themselves. Much of that may go to power generation, judging from the fact that, in one of the few fragmentary investment figures available, the Ministry of Power announced at the beginning of 1982 that capital investment in that sector is scheduled to increase by 8 percent over 1981.[29] If that is the case, then we can understand Soviet discretion about investment in coal and oil, for those two sectors may be operating on slow-growing investment budgets, which would be especially serious for coal. In other words, the price of relieving bottlenecks in the gas campaign is a further squeeze on investment in other sectors. But so far there is no sign from the public press that Soviet leaders have yet begun to address the fateful question, "How much is enough?"

As for the Soviet energy program as a whole, let us review briefly what the data discussed in this section may imply for the questions raised at the beginning of the chapter: The Soviet energy program of 1981 is vastly different from that of 1976, in conception, in spirit, in political visibility, as well as in its regional balance and in its implicit time horizon. It is an emergency program, aimed above all at getting through the 1980s by exploiting the one energy source—natural gas—that can guarantee rapid increments. But it is also a risky program, depending as it does on rates of gas development and pipeline construction that the Soviets, for all their experience in these fields, have never reached before. It is risky also because it bets that oil and coal production can be maintained or even slightly increased without a massive increase in the rate of capital spending. Lastly, it is risky because it requires major adjustments of all kinds, as the center of the gas industry moves decisively east across the Urals to regions of Siberia in which infrastructure is either thin or nonexistent. Nevertheless, given the tight squeeze that Soviet leaders see themselves to be in, the current energy program appears to be the only course available. But how did that tight squeeze come about in the first place? The next section reconstructs the main events that led to the current policy.

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[28] "Sverim chasy," Pravda, 17 August 1982.

[29] "Zadachi energetikov v 1982 godu," Elektricheskie stantsii, No. 1 (1982), p. 3.

III. EVOLUTION OF SOVIET POLICY 1972–82

Soviet energy policy over the last ten years has been highly changeable. As the Soviet leaders grew increasingly aware of the energy problems and opportunities before them, they shifted their course several times, sometimes radically. Twice in the 1970s a gas-centered strategy was considered and rejected before one was finally adopted in 1980–82. For these reasons, energy policy gives us an exceptionally interesting case study of high-level decision-making at the end of the Brezhnev period, a counterpart in some respects to the agricultural program launched at the period's beginning. This section will argue that the observed pattern of decisions of the last ten years amounts to what Edward Hewett has called "central probing," that is, a process of trial-and-error as the Soviet leaders adapted, with some delay at first and then with increasing alertness, to the shifting information coming from the field.

As late as the mid-1970s, the situation as viewed from the Kremlin must have appeared cloud-free. With the development of the major oil and gas fields of the Volga basin and the Ukraine in the 1950's and the rise of the even larger fields of Western Siberia in the 1960's, the Soviet Union, like the industrial West, had enjoyed a long period of smooth economic growth fueled by cheap hydrocarbons. If one looks back a decade to Soviet publications of 1972 and 1973, it is hard to find any public sign of high-level concern over future energy prospects. In the public summaries of his reports to the December plenary sessions of the CPSU in 1972 and 1973, Brezhnev gave hardly more than a passing reference to the subject; and Kosygin, in two of his few published speeches on domestic policy during this period, had equally little to say about energy production or conservation.[30] In September 1972 the deputy prime minister for science and technology, V.A. Kirillin, gave an entire speech to the USSR Supreme Soviet on the subject of "Rational Utilization of Natural Resources" without more than a passing mention of energy waste, except as a source of pollution.[31] The oil industry, as portrayed in the press at that time, was not without its problems, but they were mainly those of rapid growth, not of long-term shortages of supply. At the September 1972 session of the USSR Supreme Soviet, for example, speakers criticized slow construction, particularly of oil and gas pipelines and of compressor stations.[32] One of the earliest items to appear in the Soviet press with a portent of things to come was a complaint from the chief of Glavtiumenneftegaz, Viktor Muravlenko, that funding for oil exploration in West Siberia had been frozen at a constant level for several years.[33]

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[30] On 30 September 1972 Kosygin spoke to an audience of Gosplan officials and on 6 October to Gossnab. Unfortunately, only excerpts of these speeches are available. A.N. Kosygin, K velikoi tseli (volume II), Moscow: Izdatel'stvo politicheskoi literatury, 1979, pp. 149–160.

[31] V.A. Kirillin, Pravda, September 16, 1972. There is equally little mention of the subject in the discussion that follows.

[32] Speeches by Deputy P.A. Rozenko (Izvestiia, December 20, 1972) and Gosplan chairman N. Baibakov (Izvestiia, December 19, 1972).

[33] Izvestiia, 18 July 1972, translated in Current Digest of the Soviet Press, vol. XXIV, No. 29 (1972), p. 20. Muravlenko was soon to become known as one of the most pessimistic critics of the oil outlook for Tiumen', until his death in 1977. In an article in 1976 he dwelt at length on the daunting infrastructural requirements for meeting the official output targets of the 10th. Five-Year Plan. (Sotsialisticheskaia Industriia, 1 January 1976)

However, in 1973 concern about inadequate oil exploration in Tiumen' province and anxiety about the lack of hard new data on reserves became more prominent. The Middle Ob' fields, one technical specialist asserted, could not provide an adequate base for further expansion of Soviet oil output after 1980.[34] Official attention began to shift north and east of Tiumen'.[35] The tone was not yet one of panic, but in hindsight 1973 has proven to be a significant year: not one giant oil field has been discovered in West Siberia since.

By 1974 the tone of official writings had clearly begun to change and one can find evidence of greater official attention to energy policy, at least among technical experts. In that year USSR Gosplan established an Institute of Complex Fuel and Power Problems. In November 1974 energy was the major topic on the agenda of the USSR Academy of Sciences' annual meeting.[36] The energy crisis that had struck the West the year before was clearly on the speakers' minds; V. A. Kirillin, in particular, observed that one root of the crisis lay in the simple fact that annual consumption of hydrocarbons worldwide had grown to a sizable fraction of known reserves, and that it was not too soon to begin thinking about the next stage. But in these writings there was no perceptible sense of a crisis, as in the West, but rather an air of unhurried positioning for the future.[37]

If technical experts did not yet perceive a crisis, political leaders did still less. The most eloquent evidence of that is that the share of the energy sector in industrial investment fell steadily throughout the early 1970's, from 29.4% in 1971 to just over 28% in 1975. The rumblings that were coming more strongly from Tiumen' province evidently took some time to penetrate the consciousness of the leaders, although one should note that energy's investment share stopped falling after 1975.[38]

At the 25th Party Congress in February 1976[39] the leaders' speeches began to sound more like those of the technical experts, but like them they showed no particular sense of urgency. Brezhnev gave little more time to energy than he had in earlier speeches, such as his reports at year-end Central Committee plenums over the previous five years. Kosygin, for his part, stressed the potential role of coal, thus echoing the position taken by the R&D establishment in the previous year or two. Oil and gas, Kosygin declared to the Congress delegates, should be saved as much as possible for non-fuel uses. In his conception, large coal-fired powerplants would supply the Volga and Ural regions and the vast brown coal reserves of Kazakhstan and Siberia would be converted to electricity by mine-mouth plants located nearby, the power flowing to points of demand in the European USSR over the world's longest high-voltage transmission lines. To begin this long-term shift toward coal, the Guidelines for the 10th Plan called for an increase in coal output of 14 to 16 percent by 1980.

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[34] Ekonomika neftianoi promyshlennosti, No. 6 (1973), p. 8.

[35] The fact that there was communication between technical specialists and at least certain leaders over this problem can be seen from the fact that a major meeting on oil exploration, held in Tiumen' in late November 1973, was attended by Party Secretary Dolgikh, Gosplan Deputy Chairman Lalaiants, and Minister of Oil Shashin. The Tiumen' obkom First Secretary, then Boris Shcherbina (he was promoted one month later to the post of Minister of Oil and Gas Construction), criticized the geologists for their failure to move north. (Pravda, 23 November 1973) Oil Minister Shashin voiced the same concern in an article signed at about the same time. (Neftianoe khoziaistvo, No. 3, 1974, p. 4.)

[36] Vestnik Akademii Nauk SSSR, No. 2 (1975), pp. 3–31. This issue carried the speeches of M. V. Keldysh, A. P. Aleksandrov, V. A. Kirillin, and M. A. Styrikovich. Already in Keldysh's introductory address and in Kirillin's article one can find the stress on coal that became the centerpiece of official energy policy at the 25th Party Congress in February 1976.

[37] Neither was the stress on coal entirely new, as one can see from an article by the economist Tigran Khachaturov, "Natural Resources and the Planning of the National Economy," in Voprosy ekonomiki the year before (No. 8, 1973, pp. 16–29, translated in Current Digest of the Soviet Press, vol. XXV, No. 49 (1973), p. 6). Khachaturov observed, "Since petroleum reserves are not as great as coal reserves, their use as fuel must be limited; petroleum should be used increasingly as a raw material for obtaining products of organic synthesis. . . . It will be better to use gas not as a fuel but as a chemical raw material." But it is clear from the context that Khachaturov was writing about what he considered to be a fairly remote future.

[38] Narodnoe khoziaistvo, relevant years. A graph describing energy investment trends for the decade of the 1970's will be found on p. 93.

[39] The discussion which follows on pp. 89 through 95, on the chronology of Soviet energy policy between 1976 and 1981, is an updated and amplified version of the author's chapter in Seweryn Bialer and Thane Gustafson eds., The Soviet Union at Crossroads (London: Allen and Unwin, 1982), pp. 121–139.

But instead the coal industry in 1980 came in a phenomenal 74 million tons short of the low end of the initial 10th Plan target; very few new coal-fired powerplants were actually built (and no oil-fired ones were converted to coal); and the preliminary groundwork for the high-voltage transmission lines had barely begun by the time the next Party Congress opened in 1981. What had gone wrong? The reasons had been long in the making: one of the main ones was poor technological modernization in the coal industry,[40] another (related to the first) was a history of underinvestment.[41] The 10th Plan had not changed this pattern of apparent neglect. For all the leaders' stress on coal at the 1976 Party Congress, they had not backed up their words with a vast flow of new money. On the one hand, it is true, during the three years in which the coal strategy enjoyed official favor in the leaders' speeches, capital investment in the coal industry accelerated (by 2.2 percent in 1976, 5.6 percent in 1977, and 10 percent in 1978);[42] but these were years of steady absolute growth in investment for other energy sources too, and as a result the investment share of coal actually declined, from 15.6 percent of total energy investment in 1975 to 15.2 percent in 1978.[43]

These figures, surprising as they may be, do seem to translate the leaders' true intentions for coal in the mid-1970's. Indeed, the 10th Plan Guidelines actually projected a decline in the share of coal in the total energy balance, from 30 percent in 1975 to 26 percent in 1980.[44] If one were to infer from the investment statistics which energy source had the leaders' actual favor during the first half of the 10th Plan, the answer would be oil and gas, not coal.

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[40] For background on Soviet coal and on technological innovation in that industry, see the chapter by William Kelly in U.S. Congress, Office of Technology Assessment, Western Technology and Soviet Energy Availability (Washington, D.C.: USGPO, October 1981); Central Intelligence Agency, National Foreign Assessment Center, USSR: Coal Industry Problems and Prospects, ER 80-10154 (Washington, D.C.: March 1980) and same, Central Siberian Brown Coal as a Potential Source of Power for European Russia, SW 80-10006 (Washington, D.C.: April 1980); and Robert W. Campbell, Soviet Energy Technologies (Bloomington, Indiana: Indiana University Press, 1980), chapter 4.

[41] For the three years prior to the 1976 Party Congress—and these were the years in which coal was being spoken of so warmly as the energy source of the future—actual investment in coal remained virtually unchanged. See Narodnoe khoziaistvo SSSR, relevant years.

[42] Narodnoe khoziaistvo SSSR, relevant years.

[43] Narodnoe khoziaistvo SSSR, relevant years.

[44] See A. M. Nekrasov and M. G. Pervukhin, eds., Energetika SSSR v 1976–1980 godakh (Moscow, "Energiia," 1977), p. 149.

From 1975 through 1977, the share of oil and gas in total energy investment (as *Narodnoe khoziaistvo* defines it) increased from 51 to 54.6 percent.

When confronted in 1977–78 with impending disaster in the coalfields the leaders did not react with a crash coal program. On the contrary, during the last two years of the 10th Plan coal investment grew only modestly (2.9 percent over the two years); and since overall energy investment (ex-transport) increased by 12.5 percent during the same period, coal's share in overall energy investment declined substantially (from 15.2 percent in 1978 to 13.9 percent in 1980).[45]

In sum, the eclipse of the coal strategy, half-way through the 10th Plan, seems mainly due to two things: first, the leaders were unpleasantly shocked by the combination of sharp decline in hard-coal underground mining and poor progress in brown-coal strip mining, which together caused the dramatic underperformance of the coal industry in the 10th Plan; and second, they had evidently thought of coal all along not as a near-term savior, but rather as a long-term successor to hydrocarbons.[46] Consequently, when faced in late 1977 with what they perceived as an imminent energy crisis, the Soviet leaders quickly dropped the programs of 1976 and turned away from coal, searching instead for energy sources that would give them quick results.

Their first answer was oil. In an abrupt shift in 1977, Brezhnev launched a crash program to speed up West Siberian oil output. In his speech to the December 1977 plenum of the Central Committee Brezhnev stressed the decisive importance of Tiumen'.[47] In the months following, there was a good deal of discussion over the course to take, during which officials with links to Tiumen' lobbied vigorously for Siberian oil.[48] It is interesting to note that most major officials in Moscow, including Baibakov and Kosygin, did not immediately follow Brezhnev's line, and during the winter and spring of 1978 Brezhnev did some campaigning, reminiscent of his efforts to launch his agricultural policy in the late 1960's. The new line was apparently consolidated following a trip by Brezhnev to Siberia, in the spring of 1978,[49] and by a strongly-worded speech to the 13th Komsomol Congress in April, 1978. In December an "enlarged session" of USSR Gosplan officials was convened to review the practical issues of speeding up energy development in Siberia.[50]

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[45] Soviet investment in coal went from 2035 million rubles in 1978 to 2020 million in 1979 and 2094 in 1980, in other words a 0.7 percent drop in 1979 and a 3.5 percent increase in 1980. During the same period overall energy investment (not including energy transportation, however), increased from 13405 million rubles to 15084. Narodnoe khoziaistvo SSSR, relevant years.

[46] Some Big Coal advocates evidently had a different opinion. Western visitors to Moscow in recent years have been told that for a time the idea of transmitting "coal by wire" from Siberia competed in Gosplan technical councils with the Big Gas plan to transmit gas by pipeline.

[47] Brezhnev's speech has not yet been reprinted in its entirety. A paraphrase appeared in an editorial in Pravda, 18 December 1977.

[48] See in particular an article by Tiumen' obkom 1st. secretary G. P. Bogomiakov in Literaturnaia Gazeta, 18 January 1978, in which he states that the December 1977 plenum had determined precisely the place of the Tiumen' complex in satisfying the needs of the country for oil and gas, thus settling what Bogomiakov described as "not just a few contradictory judgments in views on the future."

[49] Brezhnev's 1978 trip to Siberia was treated by Tiumen' "patriots" as a highly symbolic event, as one may see from the words of G. P. Bogomiakov at the 26th Party Congress: "Of fundamental importance have been the instructions of L. I. Brezhnev on the future development of the fuel and power sector, the advice and comments made by him in the course of his trip to the regions of Siberia and the Far East." (Pravda, 27 February 1981.) At the time the "fundamental importance" was far from plain, since Brezhnev's trip occurred right on the heels of a similar trip by Kosygin, and the energy aspects of both trips received only modest treatment in the press.

Over the next four years Brezhnev's role in energy policy grew even more visible, although the initial stress on oil gave way in 1979 to a policy officially described as "balanced," which then led in 1980 to a rapidly growing priority for gas. But Brezhnev's hand was visible throughout. At the 26th Party Congress the shift toward gas was described by Prime Minister Tikhonov as Brezhnev's initiative. During the same period, the apparent role of the Central Committee staff has grown also, whereas prior to 1977 it was the staff of the Council of Ministers and of Gosplan that seemed to be more prominent in energy policy. V. I. Dolgikh, the Central Committee secretary in charge of heavy industry, has played a steadily larger role in energy matters.[51]

The official investment statistics dovetail neatly with the change in tone of official speeches after 1977. The share of investment in energy development, measured as a percentage of total industrial investment, took a sudden jump after 1977 and continued climbing rapidly from 1978 through the end of the 10th Plan in 1980. During that time energy's share increased from 28.1 to 32.4 percent.[52]

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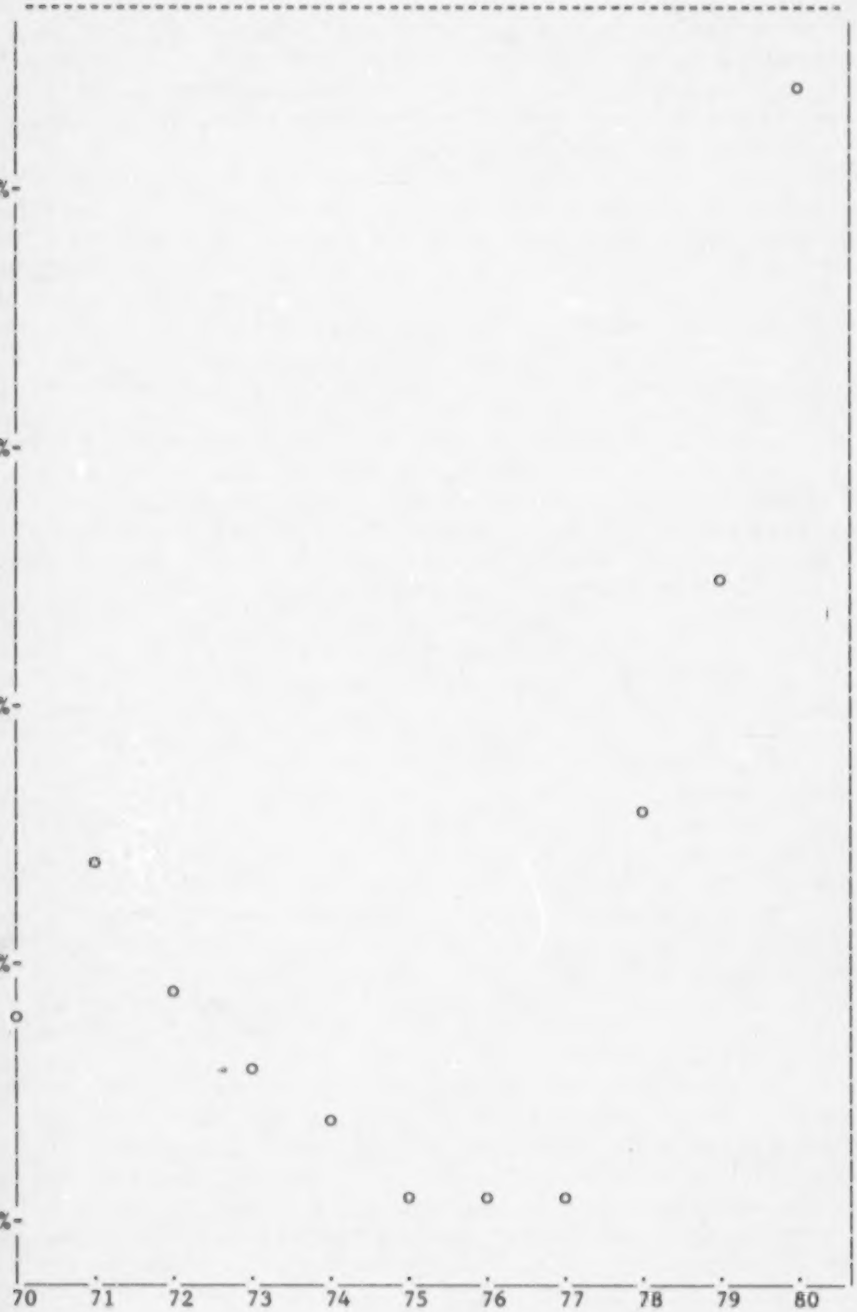
[50] See A. Granberg, op. cit., p. 73. The Gosplan meeting was followed in June by a big conference at Academic City in Siberia on the same subject, followed by detailed recommendations.

[51] In January 1980, for the first time, an article on energy policy appeared under Dolgikh's byline in Partiinaia zhizn'. In addition, in the last two years years Dolgikh's name has appeared regularly in Soviet accounts of major official meetings on energy.

[52] Source: Narodnoe khoziaistavo SSSR v 1980g, (Moscow: "Finansy i Statistika" 1981), p. 338. The pattern of investment in gas was more complicated. Although the overall trend during the last three years of the 10th. Plan was upward, there were two sharp dips in investment growth, in 1977 and 1979. These may have been due to political tugging and hauling, but they can also be plausibly explained as resulting from the inability of the gas industry to absorb the additional investment it was getting.

ENERGY AS A PERCENTAGE OF TOTAL INDUSTRIAL INVESTMENT 1970-79



The statistical handbooks also confirm that beginning in 1978 oil investment likewise took a sharp upward turn, increasing its share in industrial investment quite dramatically, from an average of 9.5 percent in the first half of the 1970s to 14.3 percent in 1980, roughly a doubling in the absolute annual amounts invested. In sum the energy sector appears well on its way to re-occupying the 40-odd percent share it routinely held in the 1950s, before the Soviet economy shifted to cheaper hydrocarbons.

The latest turn in Soviet energy policy came in 1980–81, with the dramatic shift of priority to gas that has already been described. One of the most interesting aspects of the recent history of Soviet energy policy is that the leaders had already twice examined, and twice rejected, a Big Gas program earlier in the 1970's before accepting it in 1980 as the centerpiece of their policy. Did they miss an important opportunity five and ten years ago by not committing themselves to gas earlier? If they had shown more imagination and foresight then would they have avoided the pinch they face today?

The answer is no. Without giving the Soviet leaders more credit for foresight than they necessarily deserve (we have, after all, many indications of their failure to respond quickly to the gathering evidence of trouble in oil and coal), in the case of gas they probably made the right decision. Consider, after all, the state of knowledge and skills in that industry ten years ago. The technology required to ship gas at 75 atmospheres or higher (without which the proposition is hardly efficient) was not available in the Soviet Union so that the gas option would have meant even greater dependence on foreign technology than now. The infrastructural base in North Tiumen', skimpy as it is even today, was nonexistent then, and the expense of a Big Gas program would have been astronomical. Reserves in North Tiumen' were not nearly so well known, and the gas industry had little experience in working in such rugged conditions. Above all, five and ten years ago the oil option looked much more cost-effective. If all other things are equal, after all, oil is the more versatile fuel and the better money-earner, as well as being cheaper to ship (indeed the preferred Soviet strategy in the future may shift to using gas to free oil for export). In sum, on both the positive and negative sides of the ledger it was not until the end of the 1970's that the Big Gas option stood out as the most attractive course.

In sum, interpreting the twists and turns of recent Soviet energy policy does not require reliance on complex political causes such as a divided leadership or feuding bureaucracies or inter-regional rivalries. Such elements were undoubtedly present; but one can account for what happened equally and convincingly by viewing it as the result of the leaders' attempts to respond to shifts and changes in the situation in the field. They were slow to react to the gathering threat; and having reacted they may have treated the energy problem as more of a crisis than it really warranted (thus neglecting programs that do not respond well to crisis treatment, such as conservation). But the pattern of decisions taken over the last ten years in the energy field is very far from the "incremental" or "immobilist" or "bureaucratic" styles that one might have expected from the Kremlin geronts of the late Brezhnev period.

Another apparent lesson of recent energy policy is that boosterism by regional or institutional advocates has not had much effect. Vigorous lobbying by gas enthusiasts, in particular, failed to sway the Politburo into a premature investment in gas in the 1970's. It was not for lack of effort on their part: as early as the 1960's, when the major North Tiumen' gas fields had just been discovered, supporters of the gas option made extravagant claims about the output levels that could be gotten from them; indeed, it is striking that the figures being bandied about in the mid and late 1960's were no less large than the ones one now hears in the early 1980's. In those days the most vocal enthusiast of North Tiumen' was Boris Shcherbina, then first secretary of the Tiumen' obkom and now the minister in charge of pipeline construction.

A second theme for reflection stimulated by the chronology of the last ten years is whether Soviet energy policy, having shifted and turned throughout the 1970s, has now reached a stable course for the decade of the 1980s. As far as Brezhnev is concerned (at least to judge from his words at the 26th Party Congress), the new energy priorities are intended to hold for at least the next ten years. "I consider it necessary," Brezhnev stated in his report to the Congress, "to single out the rapid development of Siberian gas output as a task of first-class economic and political importance. The deposits of the West Siberian region are unique. The largest of them—Urengoy—has such gigantic reserves that it can meet for many years both the internal needs of the country and its export needs, including to the capitalist countries."

But the enormous political and administrative challenges of the Soviet energy program make one wonder how stable the present course will turn out to be, especially in view of Brezhnev's evident determination (judging from the May 1982 plenum of the CPSU Central Committee)[53] to maintain or even to increase slightly the investment share allocated to agriculture. Can the new Soviet leaders really afford to pay the gas bill? Have they not overprovided for their needs, especially if overall economic growth (and therefore overall energy demand) turn out to be lower than planned?

In the next section of this chapter we shall attempt to gain at least impressionistic answers to these questions by examining three major lines of stress in the current energy policy.

IV. Issues and Challenges in the Present Energy Policy

In adopting an energy policy heavily centered on gas, the Soviet leaders have taken the only course that can deliver quickly a large increase in primary energy output while simultaneously displacing scarce oil. But the policy is also risky, as we have seen, because it is lopsided and ambitious. Two things could go wrong: first, the Soviets may fail to meet their targets for gas output and transmission; second, even if they succeed there, they may still not be out of trouble, because the other energy sources may fall short, and rigidities in the consumption structure may prevent the Soviets from offsetting the shortfalls with gas. By the mid-1980's the Soviets could end up simultaneously with a gas glut and a shortage of everything else.

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[53] At the May 1982 plenum Brezhnev named agriculture's share as 27-28 percent, whereas at the November 1981 plenum the figure named was just over 27 percent.

The chances of avoiding that bleak outcome depend on how skillfully the implementors of the energy policy manage to contain three main problems: First, they must provide adequately for near-term policies without crowding out necessary preparation for the longer term; second, they must limit the strains and waste that necessarily attend a crash reallocation of resources, preventing them from dissipating their efforts or from driving costs through the roof; and third, they must overcome barriers to substitution among energy sources.

Even if Soviet managers are only moderately successful in these three tasks, that may be enough for the energy program to meet the leaders' essential purposes, but for a reason that will not cause the Kremlin much joy: overall economic growth (to judge from the results of the first two years) is likely to run far behind the targets of the 11th Plan, and consequently energy demand is likely to be much smaller than original estimates foresaw. However, here lies concealed one last potential danger to the energy program: if overall economic growth is slow (say, on the order of 1% a year), then decision-makers in Moscow may decide that they have overprovided for the energy sector. Political pressure may then grow to cut back energy investment, so as to free investment resources for other sectors of industry. Such a slowdown, particularly if it led to cutbacks in energy substitution, conservation, and R&D programs, could open the way to a second, more serious round of energy problems in the latter half of the 1980's.

FINDING A SOUND BALANCE BETWEEN NEAR AND LONG TERM

Reallocating resources for a crash energy program means not only transferring them across regions and institutions, but also finding the right balance between programs that will pay off in the first half of the 1980s and those that will ensure Soviet energy supply over the long term. Since the general orientation of Soviet energy policy as recently as the mid-1970s was toward a leisurely, long-term replacement of hydrocarbons, the thrust of the two major changes since then (in 1977 and 1980), first toward oil and then toward oil and gas together, amounts to a shortening of decision-making horizons to deal with a crisis increasingly viewed as imminent. Given the inertia of the command system, Soviet managers must guard first of all against the danger that the previous unhurried outlook may continue to prevail in design offices and ministry glavki throughout the country, and simultaneously against the likelihood that the sudden increase in resources for the energy sector as a whole may encourage bureaucratic entrepreneurs at every level to make big plans for their pet projects, reasoning that in a rising tide of money all options rise together. There is a long history of technological overambitiousness and premature technological choices that Soviet leaders must beware of.[54]

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[54] See an excellent discussion of this point by Robert Campbell in "Planning and Management of Energy R&D in CMEA," (Paper prepared for the April 1981 NATO colloquium on energy in the CMEA, 1980-1990, Brussels, Belgium).

In short, one of the main problems of Soviet energy policy is to make sure that resources are concentrated on the most urgent business.

But the delicacy of such a balancing act lies in identifying the right balance point and then—even more difficult—in enforcing it. When resources are scarce and performance targets reward managers for near-term performance, the pressure for immediate payoffs can crowd out preparation for the longer term. Indeed, short-sighted practices over the last two decades are partly responsible for the present energy squeeze: in the oil industry, the Soviets contributed to their present troubles by skimping on innovation of modern exploration techniques and by pursuing a development policy aimed at extracting oil as rapidly as possible, evidently discounting the cost in lost capacity over the long term; and in the coal industry, they delayed the move across the Urals to the open-pit fields of Kazakhstan and failed to press ahead in developing the necessary machinery for high-volume strip-mining. Against this past record, will Soviet planning manage to strike a better balance now?

This question actually has two parts, which must be considered separately: first, is any noticeable displacement actually taking place from long-term approaches to near-term ones, or the opposite? Second, what are the likely consequences? On the first question, the record so far suggests a definite drawing in of horizons. The current energy policy as a whole, by its very conception, can be regarded as biased toward the short term, since by its emphasis on production over consumption it does little to attack the causes of inefficiency that make Soviet industry one of the most energy-intensive in the world; and its emphasis on gas likewise points above all toward the short term.

Within the gas industry itself, industry managers are clearly concentrating on getting through the current five-year plan: they have recently made a series of short-horizon decisions, such as slowing down development of Yamburg and the Yamal peninsula to focus their resources on Urengoy,[55] concentrating the pipelaying effort on the six major lines out of Urengoy and running them down a single corridor to save money on infrastructural development and to facilitate access and maintenance; delaying a large-scale step-up of pipeline pressures from 75 atmospheres to 100, and avoiding a commitment to permanent and long-term urban development in north Tiumen', relying on flying in labor teams instead. Elsewhere in the energy sector, programs to deploy new technologies for tertiary oil development, modern oil exploration, high-voltage transmission of electricity, and utilization of brown coals, despite the extensive publicity given to them, have been hampered by inadequate funding or lack of determined administrative support from planning agencies and ministries.[56]

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[55] I. Ognev, "The Road to Yamburg," Sovietskaia Rossiia, 13 March 1982; translated in Current Digest of the Soviet Press, vol. XXXIX, no. 9 (1982), p. 5.

[56] A revealing example is the dismissal of Deputy Oil Minister Khalimov, who until last fall was in charge of enhanced oil recovery techniques. (V. Sevast' ianov (CPSU Central Committee Party Control Commission), "The Cost of Connivance," Sotsialisticheskaia Industriia, 4 October 1981, translated in FBIS, 8 October 1981, p. 1.). The bill of particulars against him, however, reveals above all how little support he received from the rest of the ministry, and what an impossible, overambitious assignment he was given.

Such a policy of near horizons, whether accidental or deliberate, is not necessarily irrational in its effects, if one compares the immediate opportunities available with the future ones now being delayed or postponed. Gas reserves at Urengoy, for example, are now known to be far larger than they appeared to be only a few years ago; consequently the decision to slow down development of Yamburg for the time being was sound. Similarly, it is far from clear that future energy technologies are ripe enough yet to warrant massive investment in them; even the most enthusiastic boosters of synthetic fuels from coal, for example, concede that they face enormous problems,[57] and funding for those programs has remained modest.

The same is true of the "coal by wire" option for long-distance power transmission. The 1500-kilovolt DC line from Ekibastuz to the European USSR, after years of bureaucratic battle and technical debate, has been moved to second place in the planners' priorities, behind the 1150-kilovolt AC lines from Ekibastuz to users in the Urals and Kazakhstan, regional power supply; the technology for the latter is more mature than for the former, and the AC lines will free much-needed railroad capacity currently being used to ship coal in Siberia and Central Asia.[58]

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[57] In view of the fact that Soviet synthetic-fuel technologies are manifestly unready for scale-up, it is somewhat mystifying that Soviet leaders are giving as much attention to the Kansk-Achinsk coal fields as they are. For a review of the recent history of Soviet coal-based synthetic fuels programs, see S.M. Loktev, "Iskusstvennoe zhidkoe toplivo: proshloe, nastoiashchee, budushchee," Vestnik Akademii Nauk SSSR, No. 1 (1982), pp. 123-133. The current revival of attention and official priority to synthetic fuels was given a boost by Brezhnev at the 26th. Party Congress. (See Theodore Shabad, "Soviet to Use Coal to Make Liquid Fuel," New York Times, 15 March 1981). The place of the synthetic-fuels program in the overall plan for development of Siberian brown coals, and the current state of the various competing technologies, are described in A. Sheindlin and I. Kalechits, "Benzin iz uglia," Izvestiia, 23 April 1981; V. Prokushev, "Ugol' KATEKa," Pravda, 13 December 1981; and L. Melent' ev, M. Styrikovich, and A. Sheindlin, "Eshche raz ob ugle KATEKa," Pravda, 16 February 1982.

[58] Construction is proceeding on both, but the first AC line is scheduled to begin delivering power in 1983, whereas the DC line is confined for the moment to a 10-kilometer stretch which will undergo reliability testing next year. (V. Shchepotkin, "Energomosty piatiletki," Izvestiia 7 June 1982.) For accounts of the technical reasons for delay in the DC line, see M. Glukhovskii, "Energomosty v budushchee," Pravda, 5 October 1981; I. Sergeeva, "Ministr rasporiadilsia," Pravda, 25 September 1981; V. Chebakov, "Na sluzhbu energetiki," Pravda 17 September 1981; and A. Posse (deputy director of the Direct Current Institute and a major figure in the development of the DC line), "Energetika," Krasnaia zvezda, 16 April 1981. A brief discussion of the background to both the DC and AC long-distance transmission programs can be found in V. Fotin (director of the Lenin Electrical Engineering Institute), "Ul'travysokie napriazheniia—na sverkhdal'nie rasstoianiia," Kommunist, No. 13 (1980), pp. 46-48. Some of the heavy politics surrounding the DC line came out into the open at the annual meeting of the USSR Academy of Sciences in 1980. See "Vstupitel'noe slovo prezidenta Akademii Nauk SSSR Akademika A.P. Aleksandrova," Vestnik AN SSSR, No. 5, 1980, p. 12. Aleksandrov was followed later in the meeting by Academician V.M. Tuchkevich (Director of the Ioffe Institute and also chairman of the Academy Presidium's Leningrad office), who denounced Gosplan's Power Department in bitter and explicit terms. It was not until late 1978, he said, that Gosplan was finally induced to place the 1500-kv. line on its list of approved projects (titul'nyi spisok). Despite Brezhnev's endorsement, Tuchkevich evidently did not consider the battle won, since he would only say that he "hoped that the resistance of the Gosplan Power Department would be overcome." (ibid., pp. 98-99). As for the reasons for Gosplan's resistance, Tuchkevich appeared to believe that they were largely technological (he referred to "colossal obstacles" in convincing skeptics that the necessary technologies were finally ready), and indeed Gosplan spokesmen are warmer about AC than about DC; but for the most part Gosplan probably opposed the DC line on economic grounds, based on studies indicating that long-distance DC transmission to the European USSR is less cost-effective than nuclear power. (Sources: A. Nekrasov and A. Troitskii (respectively head and deputy head of the Gosplan Power Division), "Ob osnovnykh napravleniiakh razvitiia teplosnabzheniia narodnogo khoziaistva," Planovoe Khoziaistvo, No. 2 (1980), pp. 45ff; and A. Troitskii, "Elektroenergetika: problemy i perspektivy," Planovoe khoziaistvo, No. 2 (1979), (pp. 18-25). According to Troitskii, the "coal by wire" option is justifiable only if the nuclear power program is seriously held up.

These examples suggest that on the whole Soviet planners have managed to contain bureaucratic pressures to plunge ahead with premature and overambitious technological choices, and that in doing so they are not foreclosing major future options. There are some exceptions, such as the forced development of the Kansk-Achinsk coal basin in Krasnoiarsk province, whose coal cannot yet be burned or shipped. Yet on the whole Soviet choices on this score seem sound.

What is less sound is that Soviet energy policy has so far failed to deal adequately with four programs that are essential to its future balance: these are nuclear power [59], open-pit coal mining, railroad development for coal transportation, and catalytic refining of oil to increase the yield of lighter fractions. These programs are as much infrastructural and logistical as they are technological; consequently, Soviet problems in them call into question not so much their choices between near- and long-term as the coherence and balance of the energy policy as a whole. That is the subject of the next two sections.

MAINTAINING COHERENCE AND LIMITING SUBVERSION

In overseeing such a massive shift of resources as the present energy policy calls for, it will be no small feat to prevent them from being dissipated. The first enemy is incoherence; the second is bureaucratic inertia and covert subversion. What steps have Soviet leaders taken to keep their energy program on course, and how successful have they been?

The most crucial front is obviously the gas industry and the pipeline program. Deploying manpower and equipment in north Tiumen' resembles nothing so much as landing an invasion force on a foreign shore. Millions of tons of equipment and tens of thousands of men must be processed through a series of narrow time slots and transshipment nodes imposed by distance and weather. Much of the coverage of the Soviet press is devoted to this logistical aspect of the gas campaign; critical bottlenecks include shortages of electricity to compressor stations and drilling teams, lack of roads and railroads, pile-ups of equipment and stocks at riverports and landing strips, primitive living conditions, and fragile worker morale with resulting high turnover. Dozens of ministries are involved as suppliers and subcontractors, and the management challenge of forging them into a smooth team is awesome.

To deal with this task Soviet managers have made a number of interesting decisions. First, the five major pipelines now being built between Urengoy and the European USSR, including the export pipeline to Western Europe, will run down a single corridor, (at least in their Siberian portion) thus saving valuable infrastructural investment, scarce manpower, maintenance costs, etc., which will more than offset the extra line distances required. This, along with the decision to slow down Yamburg and concentrate on Urengoy, may be the two most important single moves in the gas campaign, and they may spell the difference between success and failure.[60]

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[59] Not everyone agrees on this point. Voices can be heard in the Academy of Sciences for a slower pace in nuclear development.

At the 1981 annual meeting of the Academy, V.I.Popkov criticized what he called an exaggerated emphasis on the role on nuclear powerplants (slishkom pereotsenivaiut rol' atomnykh elektrostantsii). M. A. Stryrikovich called attention to the rigidity of nuclear powerplants, which cannot readily be used in a variable mode to cover peaks in demand. Vestnik Akademii Nauk SSSR, No. 7 (1981), pp. 54 and 59. In both cases the implication of their remarks is that there should be more attention given to coal utilization programs.

Next, to oversee the gas campaign, two new administrative entities have been created: in Moscow, an energy council for Siberia has been attached to the staff of the USSR Council of Ministers; and in Tiumen', an "interagency commission" for the West Siberian energy complex has been established, with the status of a Gosplan department. These bodies are less than three years old and it is too soon to know what their real powers are, but it is interesting to note that the head of the Gosplan commission was formerly chief of oil and gas industry construction for Tiumen' province and is thus a Siberian veteran with much practical experience.

In addition to these two new bodies, one can also see the Tiumen' Party apparatus at work in its familiar roles of oversight and coordination. Indeed, officials of the Tiumen' obkom claim to have been responsible for several of the major policy decisions we have already mentioned, such as the postponement of Yamburg and the single pipeline corridor.[61] It is also interesting to note that career-switching between the state apparatus and the Party has been carried as far in Tiumen' province as one can find anywhere. The Minister of Oil and Gas Construction, Boris Shcherbina, is the former first secretary of Tiumen' province, while his successor in that position, G. P. Bogomiakov, was previously director of a research institute in the oil ministry. The staff of the Tiumen' obkom Party apparatus contains several former officials of the gas and oil industries, as do the gorkoms of the major gas cities. These officials form an experienced corps of technical experts who have been moved from post to post as the front line moves forward; thus, several of the top officials of the gorkom of Novyi Urengoy are transfers from the previous front-line city, Nadym.

One of the problems that the overseers of the West Siberian energy programs must deal with is a certain rivalry between the oil and gas industries in Tiumen' province itself, which is perhaps due less to intentional subversion than to the fact that normal human and bureaucratic inertia causes people to gravitate (if left to their own devices) toward the relatively more hospitable south of the province (where the oil is) instead of the uninviting north. Until recently the oil industry was the main business of Tiumen' province, while gas ran a poor second. There have been accounts in the Soviet press suggesting that there is still a tendency for the oil industry to get preference there. For example, Pravda's economic correspondent for West Siberian oil and gas reported that the entire 1981 increment in the work plans of the construction organizations belonging to Glavtiumenneftegazstroi was going to the oil industry.[62] He wrote:

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[60] The first two of the major six lines scheduled for the 11th Plan, are already in operation. Lines No. 3 and No. 4 (the former to Novopskov and the latter to the Czech border at Uzhgorod) are currently under construction. In all cases the pipe is laid well before the compressor stations are installed; and it normally takes three years to bring the line to full capacity. However, in the present program the aim is to reach capacity within one year; the single corridor design may be the new element that makes this feasible.

[61] B. Trofimov, "Formirovanie tiumenskogo nefte gazovogo kompleksa," Planovoe khoziaistvo, 9-1981, pp. 84-88. On the role of Party officials in campaigning against development of the more northerly fields, see E. G. Altunin, "Strategiiu vybrat' segodnia," Ekonomika i organizatsia promyshlennogo proizvodstva, No. 2 (1979), pp. 12-22.

> It is necessary, of course, to develop the base for oil extraction; there can be no two opinions about that. But who will fulfill the development program for the gas industry? (. . .) Builders are reluctant to go to the far north, where the gas has been discovered. Moreover, there are already well-established relations with the oil industry, and the transportation network in the Middle Ob' area (i.e., the oil region of Tiumen' province) is a lot easier than in the north of the province. But in the interests of the cause it is essential to shift the construction workers to the new tasks.

Gas officials (and even local Party apparatus workers) complain that oil regions in Tiumen' province have been systematically favored in road construction, housing, and project infrastructure. Thus the Ministry of Transportation Construction (Mintranstroi) built "several thousands of kilometers" of hardtop roads in Tiumen' province during the 10th Plan,[63] but only 150 kilometers in the gas region,[64] and only 10 of that at Urengoy, the largest single field,[65] Clearly the prospects of the gas industry in the 1980s will depend not only on its de facto priority in the allocation of resources in Moscow, but also on the extent to which that priority is enforced at the local level as well. Recently steps have been taken to lessen this competition. For example, the glavki previously in charge of both oil and gas development have been split in two, so that the gas operations are now independent of the oil.

Putting the Siberian energy complex under unified control is a halfway measure that stops short of creating an overall agency for the energy sector as a whole, a step that has had a number of public advocates over the last few years but for which the leaders have evidently not seen a convincing need. Indeed, while there is no overall "energy tsar" on Soviet organization charts in Moscow, the energy sector's current status as one of the regime's top domestic priorities undoubtedly means that it is receiving concentrated and sustained attention from the Party Central Committee, and this fact may obviate the need for a formal energy body. Hitherto two Party secretaries, Kirilenko and Dolgikh, divided up the job of overseeing the energy sector (Kirilenko focusing on power and Dolgikh on oil and gas), but more recently Kirilenko's resignation and Dolgikh's political ascension (culminating recently in his appointment to candidate membership in the Politburo) have apparently unified responsibility for energy in the latter's hands.

On balance, the administrative devices used by the Soviet leaders to implement their energy policy are not substantially different from ones they have used on major campaigns in the past. Their strength is that they guarantee concentration of effort, attention, and resources on the top-priority tasks. Whether the same devices will work this time depends on two things: (1) whether they can be adapted to a program that is (as the Soviet press points out) "larger than BAM, KamAZ, and Atommash put together," and (2) whether the concentration of effort on gas development can be prevented from disrupting the rest of the energy program, particularly on the consumption side. That is the subject of the next section.

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[62] V. Lisin, "Gaz Sibiri," Pravda, June 15, 1981.

[63] B. Trofimov, "Formirovanie tiumenskogo . . .," op. cit., p. 84.

[64] V. Dinkov, "Zveno energeticheskoi . . .," op. cit.

[65] Iu. Topchev, "Problemy gasovogo kompleksa," Ekonomicheskaia Gazeta, No. 24, June 1981, p. 14.

SUBSTITUTION AMONG ENERGY SOURCES

Perhaps the most important key to success in Soviet energy policy is smooth substitution among energy sources.[66] In the long run, the energy sector can be compared to a set of communicating vessels: a surplus of one energy source compensates for a shortage of another. But such substitution is not instantaneous, especially in the Soviet command economy, where price incentives do not move managers in the same ways as in the West. In the short run, there are more or less impermeable administrative and technological barriers that limit the rate at which one energy source can replace another. Therefore, while in the long run Soviet planners have shown they are able to supply the economy with a reasonably efficient mix of the energy sources available, in the short run inflexibilities in the energy consumption pattern could produce awkward imbalances, even if the overall growth target for primary energy is met.

Indeed, this may already be happening; one sign is that Soviet oil consumption still rose rapidly in 1981.[67] The leaders' goal, of course, was the opposite: They need to substitute abundant energy sources for scarce ones, near ones for far ones, high-quality and high-value for low. Above all, that means displacing oil, which not only frees crude oil for export but also for conversion to badly-needed lighter fractions. Obstacles to this arise from two directions: inadequate supplies of alternative energy sources and sluggish adaptation of demand.

On the supply side, problems arise chiefly from the fact that two of the most important alternative energy sources—coal and nuclear power—are lagging behind plan and will not be available in sufficient quantities to displace as much oil as Soviet planners had hoped, at any rate in the region that counts most, the European USSR. Coal production has been declining in absolute terms since 1978 and has not met an annual plan target since 1976. Although production stabilized in 1982, the Soviets are far from the goal they have set for 1985, modest as that is. What is worse, the fields in decline (chiefly those of the Donbas) are those that supply the best coal and require the least transportation. This problem will grow more serious as time goes on, since most of the scheduled expansion of the coal industry will come from brown coal deposits east of the Urals, but satisfactory ways of making that energy available to the European USSR on a massive scale do not yet exist. Consequently, even as they press for accelerated development of open-pit mining east of the Urals[68], Soviet energy planners are forced to use most of the eastern coal locally, in the Urals and Central Asia,[69] whereas the real energy shortage is in the European USSR.

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[66] In this discussion I am somewhat arbitrarily distinguishing between substitution and conservation, although in practice the two overlap closely.

[67] Hewett (1982), op. cit.

[68] In the fall of 1981 the CPSU Central Committee and the USSR Council of Ministers issued a joint decree to accelerate the development of open-pit mining in the 1980's, but past experience suggests that improvements will be slow, largely because the production of new machinery for strip-mining has been repeatedly held back. (TsK KPSS i Soviet Ministrov SSSR, "O dopolnitel'nykh merakh po uskoreniiu razvitiia dobychi uglia otkrytym sposobom v 1981-1990 godakh," Pravda, 4 October 1981).

To displace oil in the regions west of the Urals Soviet planners are banking on nuclear power, which is supposed to provide the entire increment to electrical generating capacity in the European USSR during the 11th Plan. This would require bringing about 5 gigawatts of new capacity on line each year. But in 1981 the nuclear industry only completed 3 gigawatts, and the 1982 plan calls for only 2.3.[70] These rates imply that, without saying so, Soviet planners may already be resigning themselves to a substantial shortfall in nuclear power by 1985; instead of the 220 billion kwh called for in the 11th. Plan for 1985, current growth rates will limit the nuclear share to only about 176 billion.[71] If that turns out to be the case, then only the slow growth of the Soviet economy will save industrial users in the European USSR from further serious blackouts and brown-outs, which are already a burdensome problem.[72]

A third obstacle to substitution on the supply side is slow progress in developing capacity for catalytic cracking of oil. Hitherto the Soviets have used much of their oil (currently about half) in the form of mazut (heavy fuel oil) under boilers, and have not needed much advanced refining capacity. Current plans, however, call for an increase in what the Soviets call "deep refining," so as to end up with a refinery mix with less fuel oil and more light fractions, what the oil industry calls a "whiter barrel." The program includes modernization of some existing refineries and construction of several new ones,[73] but its aims are modest: by 1985, even if all goes well, it will add only a few "tens of millions of rubles" worth of light fuels and feedstock to the economy. Moreover, Soviet planners apparently need all the mazut they can get, which caused the minister of the refining industry, in a recent article, to wonder how much raw material his ministry will be able to get for their catalytic crackers once they have built them.[74]

On the demand side, the chief obstacles to substitution arise from the fact that most of the measures needed to shift from one energy source to another require either substantial investment or sacrifices and risks on the part of managers. The following checklist of measures illustrates the problem:

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[69] By 1985, according to the plan, Ekibastuz and nearby fields will supply up to 170 million tons of coal annually, feeding powerstations in Central Asia, the Urals, and Kazakhstan, whose combined capacity of 36 to 38 gigawatts will produce an annual output of 220 billion kwh., or about one-seventh of total 1985 Soviet power production. Of that total, 100 billion will be in Kazakhstan and another 80 in other regions east of the Urals. Only 40 billion will be shipped (whether by wire or by train) to the Urals or to the European part of the country. Several major powerplants are being built or expanded in the Urals region proper to use Ekibastuz coal. These figures suggest that Ekibastuz is considered for the moment to be primarily a regional solution, and this fact makes clear why (in addition to the technological reasons that may be involved) the AC high-voltage lines, designed to supply neighboring regions, are being given priority over the DC line, which will run to European Russia. See E. Turkebaev, "Toplivno-energeticheskii kompleks Kazakhstana," Ekonomicheskaia gazeta, No. 1 (1982), p. 10.

[70] Sources: E. I. Borisov (First Deputy Ministry of Power and Electrification), "Energetika v X. piatiletke i zadachi na 1981 god i XI. piatiletku," Teploenergetika No. 1 (1982), pp. 2–4; and same, "Itogi razvitiia energetiki v 1981 godu i zadachi na 1982 god," Teploenergetika, No. 2 (1982), pp. 2–3. Also editorial, "Zadachi energetikov v. 1982g." Elektricheskie Stantsii, No. 1, 1982, pp. 2–3.

[71] (Ibid.)

[72] See M. A. Styrikovich, "Sovremennye problemy v planirovanii razvitiia elektrifikatsii," Izvestiia, 1 June 1980; and same (but with greater urgency and detail) in "Glavnoe zveno," Izvestiia, 1 June 1981. According to the Minister of Power, P. Neporozhnii, some power grids are operating on reduced frequency almost daily and operators are obliged to ration current. ("Plius elektrifikatsiia," Pravda, 22 December 1981).

[73] "Neftepererabatyvaiushchaia promyshlennost'," Ekonomicheskaia gazeta, No. 46 (1981), p. 2.

[74] "Pererabatyvat', a ne szhigat'," Sotsialisticheskaia Industriia, 20 May 1982.

To substitute coal for oil: Adapt large furnaces and boilers to coal of declining quality and build coal-fired powerplants and retire older oil-fired ones.

To substitute gas for oil: Expand local gas feeder networks and storage systems and build gas-fired powerplants and other gas-fired boilers.

As an example of the problems entailed, the Soviet Union today has some 250,000 small boiler plants, a majority of which operate on coal, while half of the larger thermal powerplants use gas and fuel oil. Sound policy, according to Soviet fuel experts, would be to convert the small boilers to gas and the larger ones to coal.[75] But such a conversion would require a massive expansion of local gas lines, which seems out of the question for a gas ministry that will be totally absorbed in the next few years in expanding gas production and bulk transportation.[76]

As for converting large powerplants to coal, Soviet authorities point out that it is expensive and time-consuming, and it takes powerplants out of operation for long periods, a serious consideration in view of the fact that there is already a power shortage in European U.S.S.R. As a result, there has been a tendency to convert oil-fired powerplants to gas instead, and even that process has been lagging.[77]

One of the reasons why a shift to coal is unattractive to users is that its quality is declining rapidly, yet little has been done so far to enrich it, remove moisture and ash, or to bring on line new boiler types that can deal with poorer grades of coal. In addition, the declining heat content of Soviet coal makes it necessary to ship more of it; and the presence of impurities adds to down time and maintenance costs, as well as shortening the lifetime of boilers.[78]

Obstacles to substitution from both supply and demand sides come together in ways that are difficult to disentangle. A striking illustration is electricity, which plays a major role in Soviet substitution plans for the 1980's. During the 11th. Plan period (1981–85), mazut consumption in Minenergo powerstations is supposed to drop from 115 million tons (the 1980 level) to 90 million, and its share from 27.9 to 18.0 percent. As a result of the policy of limiting new construction to hydropower and coal and gas-fired plants east of the Urals and nuclear power to the west, total organic fuel demand by Minenergo should grow only 5.4 percent in the 11th. Plan instead of 23 percent as in the 10th. Plan.[79]

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[75] S. N. Iatrov, "Energy Resources: Ways to Economize," Sotsialisticheskaia Industriia, 29 May 1980. Trans in JPRS, No. 76261 (20 August 1980), p. 9.

[76] S. N. Iatrov and A. Piatkin, "Effektivnost' ispol'zovaniia toplivno-energeticheskikh resursov," Planovoe khoziaistvo, 2-1979, p. 12.

[77] M. A. Styrikovich, "Glavnoe zveno," Izvestiia, 1 June 1981.

[78] N. Kovalev, N. Tikhodeev, I. Ershov, "Kak privlech' rezervy," Pravda, 20 November 1980.

[79] Troitskii, op. cit., p. 4. In a broader sense, electrification plays a key role in the goal of "intensification" of the economy, promoting mechanization of labor and fuller use of raw materials, as well as rationalization of energy consumption by region, thus indirectly furthering the goal of energy conservation. For both of these reasons, Soviet planners anticipate major long-term growth in the share of electricity in the Soviet energy sector. For further discussion and examples, see Iu. M. Kogan, "Problemy elektrifikatsii narodnogo khoziaistva SSSR," Izvestiia Akademii Nauk SSSR, seriia ekonomicheskaia, No. 4 (1979), pp. 5–15; and A. Beschinskii and Iu. Kogan, "Elektrifikatsiia i ekonomicheskii rost," Voprosy ekonomiki, No. 4 (1981), pp. 58–68.

However, the electrical program is in increasingly serious trouble. Its principal problems can be summed up as follows: (1) completions of new capacity are running at about half the pace called for by the 11th. Plan; (2) real capital costs are climbing rapidly, which reduces the effective capacity actually put on stream for the money spent; (3) peak-coverage capacity is inadequate, resulting in unreliable supply, frequent brown-outs and black-outs; and finally, (4) conversions from oil to gas and coal are lagging.

What would it cost to put the electricity program back on track and achieve the capacity, output, and network objectives set for the 11th. Plan? According to calculations by Professor Judith Thornton, if one uses Gosplan estimates the required total capital investment for 1981–85 would be 24.9 billion rubles, or 29 percent more than the total actually spent between 1976 and 1980. However, using her own reconstruction of recent cost trends in the Soviet power industry, Prof. Thornton concludes that the official targets would actually require 31.4 billion, or 63 percent more than in the last Five-Year Plan.[80] How do these figures compare with the amounts the leaders are actually allocating so far? In 1982 investment in the electrical power sector was slated to increase by 8 percent.[81] If this rate were maintained throughout the 11th. Plan, it would add up to something over a 40 percent increase over the 10th. Plan, or about one-third of the way between what the Gosplan official estimates say would be required to meet the official targets and what Thornton says would be required. The fact that Soviet additions to capacity are also progressing at about half the planned pace may thus be more than a coincidence.

V. CONCLUSION

In conclusion, of the three urgent tasks that Soviet energy policy must satisfy—maintaining a balance between near- and long-term, maintaining coherence, and substituting among energy sources to alter the structure of demand—the record so far suggests that Soviet policymakers are doing reasonably well on the first and on the high-priority portions of the second, but poorly so far on the third. The gas campaign is slightly ahead of plan so far, electrical power capacity is growing at about half the planned rate, the oil and coal sectors are just holding their own, but the task of adjusting among energy sources in the overall consumption mix is lagging badly. When viewed in perspective, Soviet energy policy as we have described it is evolving much as one would expect a classic Soviet campaign to do: abundant (perhaps excessive) resources are being focused on the tasks that the system performs best and that promise the safest and fastest results (e.g., development of new gas output); the more difficult tasks, which require altering micro-behavior (as in conservation programs) or achieving elaborate horizontal coordination (as in substitution programs) or producing major technological innovations quickly (as in the development of long-term alternatives), are all being postponed or given secondary priority.

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[80] Judith Thornton, "The Impact of Nuclear Power on the Cost of Capital in Soviet Electric Power," (Paper delivered at the September 1981 meeting of the American Association for the Advancement of Slavic Studies, Asilomar, California.)

[81] "Zadachi energetikov . . ." op. cit.

What are the costs of such a policy? They depend mainly on whether the Soviet leaders "overplanned" their energy targets in the first place, by treating energy problems as more of a crisis than they may actually turn out to be. To that question we cannot yet give an answer. The first crucial unknown here is the performance of the economy as a whole: if, for reasons essentially independent of energy availability, the Soviet economy grows at about half the rate planners had anticipated, or less, then the policy the Soviets are currently pursuing will easily meet internal energy needs without imbalances of crisis proportions. Indeed, if the gas program is fully successful and the compressor problem can be overcome, Soviet leaders may even find themselves with an excess of gas, caused by the domestic system's failure to displace oil and by a decline in demand for gas in Western Europe. The second crucial unknown is the performance of the Soviet oil industry in the next few years: if oil production is maintained at something like its present level through the end of decade, then the Soviet leaders will have a breathing space in which to implement a meaningful program of substitution and conservation, and a comfortable exportable surplus of gas to provide hard currency. Finally, if *both* of these conditions are met, then within two or three years Soviet planners may conclude that they over-reacted in the energy sector. If Brezhnev's successors in the Politburo agree, then the energy policy may be cut back to more modest proportions, and reoriented away from its current near-exclusive focus on production.

SOVIET POLICY IN THE DEVELOPMENT OF NUCLEAR POWER IN EASTERN EUROPE

By Lesley J. Fox [*]

CONTENTS

Page
Introduction 458
The Soviet Union's decision to undertake a civilian nuclear program 460
Research and initial agreements 462
  The 1955 agreements 462
    Agreements on nuclear research 462
    Agreements on the development of equipment for the nuclear power industry 463
    The impact of the agreement on Eastern Europe's nuclear power industry 465
  The 1965–66 agreements 466
  The 1970 program 473
    The 1970–80 agreements 473
    Soviet reactor exports to Eastern Europe 482
    The role of the CMEA in the East European nuclear power industry 485
  Achievements and future prospects 487
    Soviet plans for nuclear power in the 1980's 487
    East European plans for nuclear power in the 1980's 489
    Multilateral cooperation in the CMEA 496
Conclusion 497

TABLES

1. Installed capacity in the Soviet Union before the IXth FYP 468
2. Installed capacity in the Soviet Union during the IXth FYP 470
3. Installed capacity in the Soviet Union during the Xth FYP 474
4. Units under construction in the Soviet Union as of 01.01. 1982 475
5. Planned units in the Soviet Union as of 01.01. 1982 476
6. Growth of the share of electricity generated by nuclear power in the Soviet Union 478
7. State of the nuclear power program in the CMEA (including Yugoslavia and Finland) 479
8. Share of electricity generated by nuclear power in Eastern Europe in 1980 480
9. Evolution of the installed nuclear capacity by country 480
10. Projection of the installed nuclear capacity through 1990, as of 01.01. 1982 481

APPENDICES

1. Types of reactors developed in the CMEA countries 499
2. The nuclear power program in Bulgaria 500
3. The nuclear power program in Czechoslovakia 500
4. The nuclear power program in the German Democratic Republic 501
5. The nuclear power program in Hungary 502
6. The nuclear power program in Poland 502
7. The nuclear power program in Romania 503
8. The nuclear power program in Yugoslavia 504
9. The nuclear power program in Cuba and Finland 505

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INTRODUCTION

This article provides an account of the role of the Soviet Union in the development of the nuclear power program in Eastern Europe, and the circumstances that over time modified the relationships between the Soviet Union and the East European countries concerning nuclear power. The objective is to provide a factual basis for understanding and characterizing that changing role. Some of the motivations of the Soviet Union that have been discerned may apply over a wider field than energy, so that this study may be useful in analyzing Soviet actions on other issues as well.

Some preliminary comments are in order. The several bilateral agreements between the Soviet Union and the various East European countries at various times between the 1950's and the present—they will subsequently be described—were entered into officially under the aegis of a Standing Commission for the Use of Atomic Energy for Peaceful Purposes (SCAE)[1] under the Council for Mutual Economic Assistance (CMEA). The commission's task is to develop economic relations among CMEA members and to organize multilateral scientific, technical and economic activities. Chaired by a Soviet representative, the SCAE only has authority to make recommendations to the membership. In practice, as will be seen, the CMEA and its various committees in fact simply give post facto official endorsement to policies, practices or agreements already in existence.

At the inception of the nuclear power program, the countries in the program were at varying levels of scientific, technological, and research expertise, and bilateral agreements between the Soviet Union and each of the countries established varying relationships and differentiated functions for the partners of the Soviet Union. Furthermore, since the program began at an early stage in the development of the Soviet nuclear power industry, there emerged several identifiable stages of the program differentiated according to the principal objectives sought at successive periods.

The several stages will be analyzed with special emphasis on how Soviet policy and changes in it affected nuclear development in Eastern Europe as well as how Eastern Europe, in turn, was able to incorporate its contributions into the integrated cooperation proposed by the Soviet Union.

For purposes of this study we are concerned only with the European members of the CMEA (hereafter ECMEA): Bulgaria, Czechoslovakia, the German Democratic Republic, Hungary, Poland and Romania. Agreements with Cuba, Yugoslavia and Finland will be mentioned here only insofar as they are particularly pertinent to the issue under discussion.

Data concerning the nuclear power program—as of January 1, 1982—unit by unit are assembled for each country in the appendices. They contain the location (city and river), reactor types and capacities. Dates of criticality, connection to the electric power grid and commercial operation are included as well as the dates of order, of construction start and the initial forecasts for completion. Data for these tables were collected from East European and mostly Soviet sources and completed with the databank of the Commissariat à l'Energie Atomique which is based exclusively on East European and Soviet sources and the most reliable source encountered among West European ones.

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[1] The collaboration in the field of energy is made up of four sectoral standing commissions; the three others are in charge of the Coal Industry (Warsaw, 1956), the Gas and Oil Industry (Bucharest, 1956), and the Electrical Energy (Moscow, 1956).

Two major periods can be distinguished in the development of the nuclear program and the type of relations established between the Soviet Union and Eastern Europe.

The first begins in 1954, when the Soviet Union first used nuclear power to generate electricity. Agreements were concluded a year later with each ECMEA country, and China, for the inauguration of research on the basic problem of producing electrical energy by nuclear means. However, in order to deal with political upheaval in Eastern Europe (Hungary 1956) and the risk of proliferation (China 1958), the Soviet Union halted the development of the program so that these countries ended up either pursuing research alone (Czechoslovakia), or abandoning the program altogether (Hungary). The only country that actually benefited from Soviet assistance was the GDR, probably because benefits were largely shared by the Soviet Union. Soviet readiness to transfer nuclear technology lasted only as long as it could maintain full control.

In 1965, shortly after the first VVER-440[2] was put into operation in the USSR —the prototype of the reactors which are currently the base of the East European nuclear program—the Soviet Union concluded a new set of agreements with the individual countries of Eastern Europe for the export of these reactors. The Soviet Union had restored its control but was not sufficiently advanced to manufacture all the reactors it had agreed upon. By restoring relations with the ECMEA countries, it created the conditions for future development and closed off possible relations between Eastern Europe and the West which had developed as a result of the failure of the previous agreements.

The second period started in 1970 when the Soviet Union launched a large scale domestic program. By then, the Soviet Union had acquired considerable experience with the pressurized water reactor and was ready to export it. The international energy crisis and the increase in electric power needs made the development of nuclear energy even more imperative for member countries of the CMEA. The commitments for export of reactors exceeded the capacity of the Soviet Union to manufacture and deliver, and the Soviets set about involving East European countries in some manufacture of equipment while not entirely giving up control of that process.

In 1974, Czechoslovakia took over the production of the small 440 MWe [3] reactors, leaving the Soviet Union free to work on the more powerful 1000 MWe ones. A year later, construction of the Heavy Machine Building Plant—Atommaš—was undertaken for assembly line production of 1000 MWe VVER reactors.

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[2] See appendix 1.

[3] MWe: Megawatt electric, as opposed to MWt which are thermal.

Although the Soviet Union's was the predominant role, Eastern Europe has over time become more than a beneficiary of Soviet assistance. At present there is a network of cooperation involving mutual dependence between the Soviet Union and Eastern Europe for which integration and specialization agreements were drawn through 1990.

THE SOVIET UNION'S DECISION TO UNDERTAKE A CIVILIAN NUCLEAR PROGRAM

For Japan and the industrialized nations of Western Europe, the development of electro-nuclear power was an obvious economic imperative. It is not immediately obvious why the Soviet Union chose in 1954 to undertake such a program. The Soviet Union has immense energy resources, sufficient to assure satisfaction of its needs for decades ahead.[4] In fact, in the case of the Soviet Union as well as the United States, several diversified factors intervened.

An illustration is the question a Polish journalist asked of a Soviet engineer: "Why did the Soviet Union develop nuclear power when it has such enormous reserves of mining fuel?" To this the answer was, "The Americans also have large coal reserves and are building nuclear power plants".[5] The simple reply masks a set of real problems applicable in varying measure to all countries. For the Soviet Union they fall into three categories: (1) fossil fuels are an exhaustible resource and "old" productive regions are showing signs of exhaustion; (2) "new" fields, all situated in Siberia, present serious difficulties in their exploitation; (3) the distance between the location of the resources and the areas in which they will be used raise substantial problems.

The population and the industrial centers of the USSR are concentrated in the European part of the country; the power resources are located beyond the Urals in Siberia. Bringing the resources to the point of use, therefore, involves the construction of oil and gas pipelines, high voltage transmission lines and supplementary rail facilities that substantially increase the costs of power at the point of use, apart from potential physical problems inherent in transporting either fuel or power over great distances.[6]

But Soviet electro-nuclear power is readily sustainable for several reasons. First, Soviet uranium reserves, while secret, are believed to be substantial, running from 100,000 to 160,000 tons assured and some 800,000 of additional reserves [7] or about one third the reserves of North America.[8]

Second, the Soviet Union has extensive experience with nuclear operations. Like other industrialized countries, the Soviet Union accumulated it initially in military programs. It was, however, the first country to have organized its research toward civilian applications[9] and is now in the forefront of research in thermonuclear fusion and fast breeder reactors.

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[4] C. Beaucourt (1972), p. 5.

[5] M. Rostocki (1980), p. 48.

[6] A Soviet study evaluated the cost of electricity production from different sources of energy in the European part of the USSR, in the Urals and in Siberia, Električeskie Stantsij, No. 12, 1978, in Energy in Countries with Planned Economies (ECPE), vol. 3, No. 3, February 1, 1979, p. 3.

[7] F. Barthel et al. (1976), pp. 283, 291.

[8] M.F. Duret et al. (1977), p. 11.

Third, the Soviets have a long-term policy for the preservation of fossil fuel resources and the development of nuclear power is one means of implementing it. Evidently they believe that, given a world-wide energy crisis, the U.S.S.R. reinforces its position in the world by safeguarding its conventional energy potential.

Finally, the Soviet Union elected to provide itself with much-needed hard currency. To do so, it broke, for the short term, its policy of energy self-sufficiency and exported fuels to the West, preferring to import oil from the Middle East to make up the deficit. This adaptation permitted both the exploitation of new oil fields in Siberia and rendered storage of fuels feasible.

Recent cuts of oil exports to Eastern Europe confirm this analysis and reveal another aspect of Soviet nuclear policy. With the nuclear as a leading industry the Soviet Union can count on an export product of primary importance and finds a natural market in Eastern Europe where the energy situation is ever more critical since it limited the volume of its exports. Thus, the rapid development of nuclear power in the total power production of Eastern Europe represents a cornerstone of future economic development for all the member countries of the CMEA. Such a market depends on the existence of an efficient nuclear reactor industry that in turn becomes another fundamental support of the Soviet economy.

In addition, as the second industrial world power—and for obvious international policy reasons—the Soviet Union must develop what is at the very source of its power base. The vastness of its nuclear program and particularly the forecasts for it through 1990 indicate that the USSR would like to overtake the United States, which today disposes of an installed capacity that is almost four times greater.[10]

Finally there is an ideological consideration. The Soviets have an abiding faith in technological and scientific development expressed in Lenin's famous comment in 1920: "Communism equals Soviet power plus electrification of the entire country".

In the light of these enlarged and coordinated objectives, one should not be surprised that the Soviet Union seemed ready to modify previous non-proliferation policy concerning export of nuclear technology. Well aware of the connections between military and civilian uses of nuclear power, the Soviet Union was evidently willing to accept the risk for the sake of the benefits it might gain. Both political and economic, the benefits would include a unified, economic-geopolitical entity in Eastern Europe and energy to support the industrial development of the entire region.

Thinking and planning at this level suggests that at its very inception the Soviet plan called for the mode of cooperative endeavor in which it is presently engaged; namely, to develop a nuclear program on a multi-national base fully integrating into it the East European countries. Nevertheless the possibility of some intermediate benefits as well should not be dismissed. Although Soviet research is generally more advanced, there surely were some elements of parity and even superiority in the CMEA countries.

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[9] The American Experimental Breeder Reactor brought into operation December 20, 1951 produced electricity but, unlike the Soviet 1954 one, it was not built for that purpose.

[10] As of 01.01.1982, the installed capacity in the United States is 61,105 MWe and in the Soviet Union is 16,009 MWe. Regarding the objectives for 1990, the gap should be reduced to a factor of 1.7 with an installed capacity of 141,910 in the USA and 83,000 MWe in the USSR.CEA, DPG-GIDE/82-299/J. C. Le Ralle.

RESEARCH AND INITIAL AGREEMENTS

THE 1955 AGREEMENTS

Less than a year after the first Soviet nuclear power station was coupled to the grid—June 27, 1954—the Council of Ministers of the U.S.S.R. announced its willingness to furnish nuclear aid to friendly countries for "peaceful development of atomic science, technology and national economy".[11]

Two types of cooperative agreements were made: for nuclear research in civilian domains and for the specific development of electro-nuclear equipment. Agreements of the first type were concluded with Czechoslovakia, the German Democratic Republic, Poland and Romania in April 1955 (and at the same time with China). Similar agreements were entered into with Bulgaria and Hungary in 1956. Only three agreements of the second type were concluded: with Czechoslovakia in 1955 and with the GDR and Hungary in 1956.[12]

Agreements on nuclear research

The nuclear research assistance agreements provided the ECMEA members with 2 MWe reactors. Fueled with uranium enriched to 10% with U^{235} and light water as moderator and coolant, they were of the "swimming pool" type.[13] East European countries, except Romania, were also given 25 MeV (Mega electron volts) cyclotrons[14] and other nuclear hardware. The agreements further required the U.S.S.R. to assist in the construction of nuclear research centers.

Perhaps the most important aspect of Soviet aid was the training of East European scientists and technicians in Soviet nuclear centers, chiefly at the Joint Institute of Nuclear Research (JINR) at Dubna near Moscow.[15] Jointly founded in 1956 by the Soviet Union and East European countries, JINR is the cornerstone of nuclear research and development in the CMEA.

Bulgarian scientists began working at the JINR as early as 1956. They returned with a commitment to build a water-cooled, water-moderated reactor of the IRT-2000 type. In 1961 the Institute for Nuclear Physics in Sofia was established and the IRT-2000 built.[16]

As did the other East European countries, Romania initiated nuclear research in 1956 and reorganized the Institute of Physics of the Romanian Academy of Sciences into the Institute of Nuclear Physics.

There was a long tradition of advanced scientific research in Poland.

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[11] Pravda, January 18, 1955.

[12] See also J. G. Polach, (May 1968), p. 3-12.

[13] Ju.G. N[illegible]olajeiv, First International Conference on Peaceful Uses of Atomic Energy, Geneva, Pa[illegible], 1955.

[14] A.M. [illegible]anc, (1981), p. 382.

[15] Ib[illegible]

[16] A.M. [illegible] (1981), p. 211 and V. Khristov (1980), p. 30.

As the outcome of research in radioactivity by Maria Sklodowska-Curie the Radiological Laboratory was established in Warsaw in 1912 and the Radium Institute in 1932.[17] This research experience formed a good base for work on electro-nuclear power. In connection with the agreement with the Soviet Union, the Government Commissioner's Office for Peaceful Uses of Nuclear Energy was formed in 1956 to supervise and coordinate research. Another center, the Institute for Nuclear Research, was established in Swierk at the same time and actually began working in 1958 on the 2 MWe experimental reactor and the U-120 cyclotron supplied by the Soviet Union. 1963 saw the construction of the Zero Power Reactor, a graphite light water critical assembly that can be used both for thermal and fast breeder experiments. An experimental low power swimming pool reactor was erected in 1964.[18]

Results of research assistance agreements in these countries are difficult to evaluate owing to the absence of available information. Apart from the establishment of research institutes in the individual countries virtually nothing is known about the extent of Soviet aid in terms of equipment and counsel. Given the Soviet penchant for more verbal than practical commitment to its contracts, it may perhaps be assumed that effective Soviet assistance was, in fact, quite limited.

Agreements on the development of equipment for the nuclear power industry

Agreements for research on nuclear power and the development of equipment for electro-nuclear power were concluded between the USSR and three countries: Czechoslovakia, East Germany, and Hungary.

Radiological research began in Czechoslovakia in the mid 1920's at Charles University in Prague. Research continued after World War II at the Academy of Sciences and at several universities. As early as 1952 Czech planners had recommended the development of nuclear energy for generating electricity to ease demand for Coal.[19] In 1957 the Institute of Nuclear Research in Rez, near Prague, was established after agreements with the Soviet Union that year. A year earlier Czechoslovakia became an associate member of the JINR. At about the same time the State Committee for Research and Utilization of Atomic Energy for Peaceful Purposes and the Committee for Atomic Energy were organized.[20]

Czech planners drafted an ambitious nuclear program upon the conclusion of the 1955 agreement that called for an installed capacity of 3,500 MWe in 1970 and 6,000 to 9,000 MWe by 1975.[21] The first power station, A-1, was to be equipped with a 150 MWe reactor to be supplied along with all necessary technical assistance by the Soviet Union.[22]

The Czechs chose a natural uranium, heavy moderated, gas cooled reactor (HWGCR) for two reasons.[23] First, Czechoslovakia had its own uranium deposits and judged itself able to produce its own heavy water. Second, the choice would render Czechoslovakia independent of foreign sources for the enriched uranium required by other types of reactors.[24] It should be noted that the HWGCR was not the type of reactor that was being developed in the Soviet Union; nor was it in the mainstream of reactor development. Perhaps the Czechs were able to persuade the Soviets to supply a natural uranium reactor—one easily converted to military production, by the way—because the Soviets had enjoyed since the end of WWII the privilege of exploiting Czech uranium deposits in Jachymov.[25]

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[17] J. Hurwic, p. 3.
[18] P. Josephson (1981), p. 12; A. M. Petros'Jánc (1981), p. 215; J. Hurwic, p. 18.
[19] J. Holovec and A. Komarek (1968), p. 10.
[20] A. M. Petros'Janc (1981), p. 197-204.
[21] J. Polach (May 1968), p. 6.
[22] J. Polach (Fall 1968), p. 834.
[23] See appendix 1.

As it turned out, the Soviet Union did not deliver a power reactor of any type to Czechoslovakia. Czech industry and research institutes designed and built most of the equipment with the U.S.S.R. supplying only certain components. The precise degree of assistance provided by the Soviet Union is impossible to determine. Declarations on both sides are rather ambiguous and even contradictory; but it is clear that aid was limited.[26] The results for the Czech program were near fatal. Lacking scientific and technical experience in nuclear engineering, the Czechs had to go through all the time-consuming preliminaries of developing prototypes and testing materials. Most of the research was done by industrial centers like the Skoda Works, the Vitkovice Steel Works and the Tesla Enterpise, and none of these had either nuclear experimental equipment or competent technicians.[27]

The Soviet's failure to deliver a reactor of any type led Czechoslovakia to make inquiries in Great Britain and in France in 1965 about the possibilities of purchasing a heavy water reactor.[28]

Once the limited scope of Soviet assistance became apparent, despite periodical renewal of aid agreements, the effort to build the A-1 was rendered extraordinary difficult: originally scheduled for completion in 1960, it started up only in 1972.[29]

Following the 1955 research agreement with the U.S.S.R., the German Democratic Republic initiated extensive research. Four major institutes were established: in Berlin in 1955 the Institute of Applied Isotope Research; in the same year in Dresden, the Central Institute of Atomic Research; in Leipzig in 1956, the Institute of Applied Radioactivity and the Institute of Stable Isotopes.[30]

The agreement between the GDR and the Soviet Union for the cooperative development of the GDR's first nuclear power plant was concluded in 1956. Unlike Czechoslovakia, the GDR opted for a 80 MWe water-pressurized reactor fueled with enriched uranium.[31] Although this option made it dependent on the Soviet Union for the enrichment process, the choice was evidently made for other reasons. East German scientists had heretofore been working in the Soviet Union and were familiar with the type. They considered further that working with the Soviet 80 MWe VVER provided the most rapid means for learning enough so that they could build their own reactor. In contrast to the Czech choice which did not suit the Soviet Union and perhaps disturbed it somewhat, East Germany's choice received Soviet approval. Whether the option was freely chosen or the result of heavy Soviet pressure is unknown, though the latter is the most likely. Indeed, Soviet scientists were using a VVER reactor in their research and thus the potential for joint experiments with the experienced GDR scientists was created.

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[24] J. Holovec and A. Komarek (1968), p. 12-14.

[25] J. Polach (Fall 1968), p. 833.

[26] For characteristics of the reactor and each country's participation see: V. M. Abramov et al., "The A-1 Station, Czechoslovakia's First Atomic Power Station with the KS-150 Heavy-Water Reactor (Development and Construction)", Atomnaja Energija, vol. 36, No. 2, February 1974, p. 113-124 and "First Czechoslovak Atomic-Electric Station A-1 with Heavy Reactor KS-150 (Construction, Start-Up, and Initial Experience)", Atomnaja Energija, vol. 36, No. 3, March 1974, p. 163-176. See also, A. M. Petros' Janc (1981), p. 197-204.

[27] J. Holovec and A. Komarek (1968), p. 12-14.

[28] Nucleonics, No. 2, 1965, p. 28.

[29] J. Holovec and A. Komarek (1968), p. 12-14.

[30] A. M. Petros' Janc (1981), p. 204-207.

[31] Ibid., p. 197, 204.

The AKW-1 reactor was designed by Soviet experts and built by Soviet and East German teams. Construction work started in 1960 and was completed in May 1966 (see appendix 4). Since then, however, the station has experienced problems and operation has been subject to frequent interruptions.

At the same time, the Soviet Union was developing its first pressurized-water reactor at Novo-Voronež. It was commissioned in 1964, two years before the East German reactor. Unlike the latter, it gave satisfactory results.[32]

In contrast to those in Czechoslovakia, the results in the GDR were generally successful. In fact the GDR was the only country actually to benefit from Soviet assistance. Benefits were also enjoyed by the Soviet Union. In working with the GDR on the construction of AKW-1, Soviet scientists and technicians may perhaps have relied on this experience with AKW-1 to make it the prototype of Novo-Voronežskaja-1.

An agreement signed in 1956 between the Soviet Union and Hungary, required the Soviet Union to deliver a 100 MWe reactor to Hungary to be put into operation before 1965, and the delivery of several other units thereafter.[33] The promised reactor was never delivered and the project was completely abandoned. The 1956 revolt in Hungary appears to be the reason for the Soviet Union's cancellation of the agreement.

Research in nuclear energy in Hungary had been undertaken as far back as 1950 at the Central Institute of Physical Research of the Academy of Sciences in Budapest. Some experimental work on VVER type reactors began only in 1959,[34] three years after the political upheaval in Hungary, but there were no tangible results in term of nuclear development.

The impact of the agreement on Eastern Europe's nuclear power industry

The ambitious plans heralded by the agreements between the Soviet Union and its East European neighbors concluded in the mid-fifties could, a decade later, be considered failures in Hungary and Czechoslovakia but a success in East Germany. An explanation for the differing results may provide clues to phenomena shaping

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[32] J. Polach (May 1968), p. 5-6.
[33] Ibid.
[34] A.M. Petros'Janc (1981), p. 212-213.

Soviet policy and thus to understand it. In the obvious absence of verifiable explanations, hypotheses logically consistent with the outcomes must be relied on.

Responsibility for the failures and the success is clearly the Soviet Union's. The results in the case of Czechoslovakia and Hungary are attributable to the failure of the Soviet Union to deliver promised assistance and equipment while the success in East Germany derived from the fulfillment by the Soviet Union of its obligations under the agreement. In both cases the further problem is to account for the different behavior of the Soviet Union. Since it was throughout the time quite able to furnish effective assistance, the decision to furnish or not to furnish it must therefore have been entirely deliberate. This leads to explanations having little to do with technical matters but much to do with political ones.

It must be recalled that along with four East European countries, the Soviet Union concluded an agreement with China in April 1955 in fulfillment of which China received from the Soviet Union a 6.5 MWe research reactor scheduled to start operation in September 1958.[35] In May 1958, however, after an internal debate on Soviet military aid, the Chinese declared that they would produce their own nuclear weapons.[36] Coming as this did after the Hungarian "rebellion" in 1956, it became clear to the Soviet Union that political loyalty was a condition for the retention of control over the proliferation of nuclear weapons. Consequently great doubt was cast on the wisdom of transfers of nuclear technology except to countries unimpeachably aligned with the Soviet Union and even then most cautiously. The events in Hungary in 1956 and those in China in 1958 brought an end to cooperation with countries of precarious loyalties and quite cautious moves with the others. Thus the Soviet Union did not deliver either the promised reactor or the promised assistance to Czechoslovakia. Soviet readiness to cooperative aid lasted only as long as it could maintain both technological leadership and full control.

As with Soviet decisions generally, explanations are manifold; and discouraging nuclear research in Eastern Europe is not without additional factors. By the mid 1960's the Soviet Union had so successfully exploited its extensive oil reserves that there was a surplus that could be exported in large quantities not only to Eastern Europe but to other countries as well. This oil abundance had three-fold effects, all favorable to the Soviet Union: it brought hard currency to the Soviet Union; it helped maintain East European dependence on the Soviet Union for energy; it served Soviet industrial and economic development. The need for nuclear power was a future need and thus not of immediate importance to Eastern Europe but adequate quantities of oil were an immediate necessity indeed.

THE 1965–66 AGREEMENTS

The experience with the 1955 agreements made it clear to the Soviet Union that no East European country could independently complete a nuclear program. Thus the success of any plans for construction of nuclear power stations depended on both the ability and the desire of the Soviet Union to deliver equipment to assist with the construction and possibly the operation of proposed power stations.

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[35] W. C. Clemens (1969), p. 15.

[36] Ibid. p. 18.

By 1965 three stations, besides the one at Obninsk, were in operation in the Soviet Union: one in Siberia, a second at Belojarsk and a third in Novo-Voronež. The first two are equipped with graphite moderated, light water cooled reactors—GLWR[37] (see table 1). They can be considered as the prototype for the future RBMK[38] type of reactor, a type unique to the Soviet Union which was never destined for export because of its high plutonium production. The unit at Novo-Voronež, brought on line in December 1964, employs a VVER reactor having a capacity of 278 MW. This unit was a prototype of a then forthcoming VVER with a capacity of 440 MW, the reactors which are currently the base of the East European nuclear power programs. The existence of four operating stations enabled the Soviet Union to provide equipment called for by agreements with Eastern European countries.

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[37] See appendix 1.

[38] See appendix 1.

TABLE 1.—INSTALLED CAPACITY IN THE SOVIET UNION BEFORE THE NINTH 5 YEAR PLAN

Name of Station	Other designation	Location	River	Reactor capacity MWe gross/net	Reactor type	Order	Construction start	Criticality	Coupling to grid	Commerical operation
APS, Obninsk	AM–1 Troitsk–1	Obninsk	Protva	6/5	GLWR	1951	1951	05.1954	27.06.1954	
Sibirskaja–1	Siberian–1 S AES–1 Troitsk–2	Troitsk	Uj	100/90	GLWR	1954	1954	09.1958	09.1958	
Sibirskaja–2	Siberian–2 S AES–2 Troitsk–3	Troitsk	Uj	100/90	GLWR	1954	1954	1959	1959	
Sibirskaja–3	Siberian–3 S AES–3 Troitsk–4	Troitsk	Uj	100/90	GLWR	1954	1954	1960	1960	
Sibirskaja–4*	Siberian–4 S AES–4 Troitsk–5	Troitsk	Uj	100/90	GLWR	1954	1960	1960		
Sibirskaja–5	Siberian–5 S AES–5 Troitsk–6	Troitsk	Uj	100/90	GLWR	1954	1954	1961	1961	
Sibirskaja–6	Siberian–6 S AES–5	Troitsk	Uj	100/90	GLWR	1954	1954	12.1962	1963	
Belojarskaja–1	B AES–1	Sverdlovsk (Zarecnyj)	Pysma	108/102	GLWR	1957	06.00.1958	09.03.1963	04.24.1964	08.00.1964
Belojarskaja–2	B AES–2	Sverdlovsk (Zarencnyj)	Pysma	200/185	GLWR	1959	1962	11.05.1967	12.29.1967	12.00.1967
Novovoronežskaja–1	N AES–1	Voronež	Don	278/265	VVER	1959	08.00.1959	10.18.1963	09.30.1964	12.29.1964
Novovoronežskaja–2	N AES–2	Voronež	Don	365/338	VVER	1964	1964	12.00.1969	12.27.1969	04.14.1970
VK 50	M AES	Dimitrovgrad (Melekess)	Volga	62/50	BWR	1961	1962	12.15.1964	10.20.1965	1966
BOR 60	BN–60	Uljanovsk	Volga	12/11	Breeder	1963	1965	12.28.1968	12.00.1969	1970

Source: Commissariat Energie Atomique, DPg, CIDE, 80–427, J.C. Le Ralle.

The earliest agreement was concluded with the GDR in 1965. It called for the delivery of two units of the 440 MWe VVER reactor.[39]

The GDR appears to have continued to hope that it could build its own reactors either independently or in collaboration with the Soviet Union. There was some discussion of two projects: the building of AKW-2 with a capacity of 500 MWe and undertaking ground work in Lubmin for the building of KKW-Nord, a VVER reactor of 700 MWe. Neither project moved beyond the discussion stage.[40]

In the following year, 1966, similar agreements were concluded with Hungary, Bulgaria and Czechoslovakia.[41] These called for Hungary and Bulgaria each to receive two 440 MWe reactors as well as nuclear steam supply systems. However they were expected to provide the rest of the equipment themselves including turbines and generators (see appendices 2, 3, 5).

Czechoslovakia faced a serious situation. After the problems encountered with the A-1 reactor and the Soviet Union's abandonment of the agreement, it realized that it could neither solve the problems with its own resources nor rely on the Soviet Union if it persisted in pursuing the natural uranium approach. It had two alternatives: to cooperate with the Soviet Union and import a VVER 440 or to proceed independently by purchasing a natural uranium reactor in the West. It made no clear-cut choice, simultaneously exploring the possibilities of purchase of a heavy water reactor in the West and signing the 1966 cooperative agreement for the construction of A-2 (300 MWe) with the Soviet Union.[42] The following year it made inquiries about a Soviet VVER-440, abandoning the A-3 project (500 MWe)[43] and launched inquiries in Canada in 1968, prior to the Soviet invasion.[44] After the upheaval was crushed, Czechoslovakia accepted the Soviet VVER proposal. It was then still working on completion of the A-1 reactor.

All the power stations contemplated in the bilateral agreements were to be operating by 1975. Thus the Soviet Union was obliged by the agreements to deliver five or six reactors to East Europe in addition to five it had planned to build for itself (see table 2).

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[39] CEA DPG/GIDE/ 82-299.

[40] J. Polach (May 1968), p. 9-10.

[41] Ibid.

[42] J. Holovec and A. Komarek (1968), p. 15.

[43] J. Polach (May 1968), p. 10.

[44] J. Polach (1970), p. 388.

TABLE 2.—INSTALLED CAPACITY IN THE SOVIET UNION DURING THE NINTH 5-YEAR PLAN

Name of station	Other designation	Location	River	Reactor capacity MWe gross/net[1]	Reactor type	order	Construction start	Criticality	Coupling to grid	Commercial operation
Novovoronežskaja-3	N AES-3	Voronež	Don	440/410	VVER	1965	1966	1971	12.21.1971	06.00.1972
Novovoronežskaja-4	N AES-4	Voronež	Don	440/410	VVER	1965	1969	12.00.1972	12.25.1972	04.00.1973
BN 350	Ševčenko	Ševčenko	Caspian Sea	[1]150/135	Breeder	1963	10.00.1964	11.29.1972	07.16.1973	1973
Kol'skaja-1	K AES-1 Murmansk-1	Murmansk (Polyarnye Zori)	Imandra Lake	470/440	VVER	1966	10.00.1967	06.00.1973	07.03.1973	10.00.1973
Kol'skaja-2	K AES-2 Murmansk-2	Murmansk (Polyarnye Zori)	Imandra Lake	470/440	VVER	1966	10.00.1967	1974	12.29.1974	1975
Leningradskaja-1	L AES-1	Léningrad (Sosnovyj Bor)	Finalnd Gulf	1000/950	RBMK	1968	1969	09.12.1973	12.21.1973	1974
Leningradskaja-2	L AES-3	Léningrad (Sosnovyj Bor)	Finland Gulf	1000/950	RBMK	1968	1969	07.00.1975	11.00.1975	11.06.1975
Bilibinskaja-1	Biatec-1 Bilibinsk-1	Bilibino	Malyi Anjoj	12/11	GLWR	1965	1970	12.00.1973	01.12.1974	1974
Bilibinskaja-2	Biatec-2 Bilibinsk-2	Bilibino	Malyi Anyoj	12/11	GLWR	1965	1970	12.00.1974	12.30.1974	1975

[1] The total capacity is 350 MWe, but only 150 MWe generate electricity, the balance is used for the desalanization of 120,000 m³ of water per day.

Source: Commissariat Energie Atomique, DPg, GIDE, 80-427, J.C. Le Ralle.

These ambitious goals need some examination. Without doubt, the USSR had the technical skill, and trained, experienced scientists and engineers achieve them. But such a large scale production of reactors also requires enormous investments and a viable nuclear industry. These latter conditions did not yet exist and hence the proposed time schedule was rather less than realistic.

Yet it should not be assumed that the promises were either rash, irresponsible, overly optimistic or that the Soviet Union was not aware of the problem. A necessary condition for an economically viable nuclear industry is a market large enough to absorb its production. The domestic needs of the Soviet Union alone were insufficient for this purpose but in association with the requirements of the East European countries a market of sufficient size could be created.

The Soviet Union was probably aware that timely deliveries of reactors according to contract commitments could not be expected, but perhaps it also expected that the East European countries would not in any case be ready to accept deliveries at the appointed times. Moreover, in addition to the secure market, there were other benefits to be expected from the agreements.

First, it was a way of announcing to East Europe and to the world that the Soviet Union had not only mastered the technology but also had facilities for export in place. Second, it provided a test of East Europe's commitment to a nuclear program that among other things required them to draw the necessary plans. Third, it provided a means of restoring satisfactory relations with the ECMEA that had been totally strained by the failures of the agreements of the 1950's. Finally, it bound these countries to the Soviet Union and aborted the possibility of relations with the West that might have developed from the inquiries about purchase of reactors made by Romania, Czechoslovakia and Yugoslavia (as will be seen further).

In this last instance another constant feature of Soviet dealing with Eastern Europe is recognizable. No sooner had it become able to generate electricity by nuclear means in 1954, it began research and construction agreements with the East European countries. Similarly, barely a year after it had brought its first reactor into operation it was making agreements for the export of reactors.

Thus it is possible to conjecture that a fundamental motivation of the Soviet Union is to bind East Europe and European interests to its own close off possibilities for association between Eastern Europe and the West and thereby advance the process of integrating Eastern European countries into a cohesive entity. In this instance the mechanism is the nuclear program. No statement or announcements to this effect were ever made but the pattern of behavior is such as to support the conjecture.

Coordinated with the integrating process is the matter of total control of the operations by the Soviet Union including control of proliferation risks. Provision for the latter was made by certain strict obligations imposed upon the countries entering into agreements with the USSR. In addition to the reactor type provided—VVER versus RBMK—the parties to the agreements were prohibited from developing uranium enrichment or reprocessing plants even if they mined uranium in their territory. As a condition for receiving the reactors, the recipients were required to obtain enriched uranium from the USSR and to return all spent fuel rods for reprocessing. The USSR does not export natural uranium; indeed Soviet law forbids it.[45] Such safeguards, by the way, were enacted long before kindred ones were made by any other nuclear supplier.

In addition to maintaining technical controls in agreements with its partners the USSR insists upon their political reliability and the ascendancy of Soviet policy in East European decision-making. From this perspective it can be seen why the first agreement was made with the GDR whose positions and policies are closer than ever to those of the Soviet Union. Moreover, the relatively advanced state of its nuclear research creates a situation whereby mutual benefits to the GDR and the Soviet Union are possible.

It is also clear why an early agreement was also made with Bulgaria whose political reliability was perhaps unimpeachable but whose general industrial economic development rendered questionable whether Bulgaria had the capacity to build nuclear power facilities. On the other hand perhaps Bulgaria saw nuclear power stations as the only possible answer to its energy deficiencies.

The political situation in Hungary came under control after the 1956 Soviet invasion. Hungary's need to provide energy for the bauxite-aluminum and other industrial complexes concentrated around Budapest and its general energy insufficiency were the reasons for concluding an agreement. The Soviet Union's predominant consideration for the agreement was the post-1956 political stability in Hungary.

The situation in Czechoslovakia was not wholly certain and hence the motivations for the two tentative agreements proposed by the Soviet Union were the same as those occasioning the earlier ones in the 1950's. Supplementing these was probably the desire to keep Czechoslovakia aligned with the Soviet Union and free of investment with the West.

Romania and Yugoslavia are the two East European countries that did not conclude agreements with the Soviet Union and turned to the West for the technology to develop nuclear power.

From the beginning Romania was interested in a natural uranium reactor. The reasons are similar to those of Czechoslovakia, namely preserving its independence of foreign countries for the enrichment and reprocessing of uranium. In 1964, Romania considered acquiring a natural uranium reactor, either graphite moderated from France or heavy water moderated from Great Britain, and was planning to have its first station in operation in 1980.[46] The effort ended with the inquiries.

Romania evidently learned a lesson from the Czech experience and never completely excluded the eventuality of adopting a Soviet type reactor. But since its energy situation was much more favorable than that of other East European countries because of its oil reserves, Romania was not pressed to develop nuclear power.

Although Yugoslavia is not a full member of the CMEA its choices are interesting because of its geo-political position on the border between East and West and because its energy sector has become increasingly linked to Eastern Europe and Soviet energy supplies. In fact it became an associate member of the CMEA in 1964 and participates as such in the work of some of its organs.

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[45] C. Duffy (1977), p. 30.

[46] *The Economist* (London), June 13, 1964, pp. 1215–1216.

In 1968 Yugoslavia's Energoprojekt initiated a study for a power reactor with a capacity of 340 to 500 MWe to be located near Videm on the Sava River, though it still considered hydroelectric development as being more efficient to satisfy the country's needs for electricity. No agreements were signed with the Soviet Union; rather, they considered a Swedish PHWR.[47]

THE 1970 PROGRAM

The 1970–80 agreements

By 1970 the Soviet Union had mastered the technology of the pressurized water reactor and work on the VVER-440 was sufficiently advanced so that it could export reactors to its natural market, Eastern Europe. On the occasion of the XXIVth Congress of the Communist Party of the Soviet Union (CPSU) and the promulgation of the IXth Five Year Plan (FYP), the Soviet Union launched a large domestic nuclear program, signed individual agreements with the East European countries and created within the framework of the Comprehensive Program two international economic associations—Interatominstrument and Interatomenergo—specifically concerned with nuclear power.

The Xth FYP confirmed and strengthened the trend started in 1970 for the expansion of the nuclear industry with the installation of 1000 MWe units, the decision to build the Heavy Machine Building Plant, Atommaš, for the production of VVER-1000 on an assembly line basis, the intensification of the fast breeder program and research for large capacity RBMK units. Multilateral cooperation actually began with the signing of the "Concerted Plan of Multilateral Integration Measures" adopted for the 1976–1980 period.

In 1970, the total installed capacity in the Soviet Union was 1631 MWe (see table 9). The plans called for an installed capacity of 7,000 MWe by 1975 and 30,000 MWe by 1980.

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[47] J. Polach (1970), pp. 391–392, appendix 1.

TABLE 3.—INSTALLED NUCLEAR CAPACITY IN THE SOVIET UNION DURING THE XTH 5-YEAR PLAN AND 1981—AS OF 01.01. 1982

Name of Station	Other designation	Location	River	Reactor capacity MWe gross/net	Reactor type	Order	Construction start	Criticality	Coupling to grid	Commercial operation
Bilibinskaja-3	Biatec-3 Bilibinsk-3	Bilibino	Malyi Anyuj	12/11	GLWR	1965	1970	1976	02.00.1976	12.00.1976
Bilibinskaja-4	Biatec-4 Bilibinsk-4	Bilibino	Malyi Anyuj	12/11	GLWR	1965	1970	08.00.1976	12.28.1976	1977
Armjanskaja-1	Ar AES–1 Oktemberjan-1 Erevan-1	Mecamor	Sevan Lake	[1] 440/405	VVER	1968	10.00.1969	1976	12.28.1976	1977
Armjanskaja-2	Ar AES–2 Oktemberjan-2 Erevan-2	Mecamor	Sevan Lake	[1] 440/410	VVER	1970	1970	12.00.1979	12.28.1979	
Kurskaja-1	Ku AES–1	Kursk	Sejm	1000/950	RBMK	1968	1970	09.25.1976	12.20.1976	
Kurskaja-2	Ku AES–2	Kursk	Sejm	1000/950	RBMK	1968	1971	12.18.1978	01.00.1979	
Černobyl'skaja-1	Ch AES–1 Kiev-1	Černobyl'	Pripjat'	1000/950	RBMK	1971	1971	09.00.1977	09.29.1977	1978
Černobyl'skaja-2	Ch AES–2	Černobyl'	Pripjat'	1000/950	RBMK	1971	1971	11.00.1978	12.00.1978	1978
Černobyl'skaja-3	Kiev-2	Černobyl'	Pripjar'	1000/950	RBMK	1974	1975	11.00.1981	12.00.1981	1982
Leningradskaja-3	L AES–3 (Sosnovyj Bor)	Leningrad	Finland Gulf	1000/950	RBMK	1975	1975	09.18.1979	05.31.1979	02.22.1980
Novovoronežskaja–5	N AES–5	Voronež	Don	1000/953	VVER	1969	1972	04.30.1980	05.31.1980	04.00.1981
Bn 600	Belojarsk-3	Sverdlovsk (Zarencyj)	Pyšma	600/550	Breeder	1968	1969	1980	04.00.1980	04.00.1980
Rovenskaja-1	Za AES–1 West Ukraine-1 Rovno-1	Kuznecovsk	Styr	440/420	VVER	1971	1973	12.00.1980	12.22.1980	1981
Rovenskaja-2	Za AES–2 West Ukraine-2 Rovno–2	Kuznecovsk	Styr	440/420	VVER	1971	1973	11.00.1981	12.00.1981	1982
Leningradskaja-4	L AES–4 (Sosnovyj Bor)	Leningrad	Finland Gulf	1000/950	RBMK	1975	1979	12.30.1980	02.00.1981	1981

[1] Due to coupling conditions.

Sources: D'après Commissoriat Energie Atomique, DPg, GIDE, 82–299, J.C. Le Ralle.

TABLE 4.—UNITS UNDER CONSTRUCTION IN THE SOVIET UNION AS OF 01.01. 1981

Name of station	Other designation	Location	River	Reactor capacity MWe gross/net	Reactor type	Order	Initial Operation forecast	Commercial Operation Forecast
Smolenskaja-1	Sn AES-1	Smolensk	Desna	1000/950	RBMK	1973	1978	1983
Smolenskaja-2	Sn AES-2	Smolensk	Desna	1000/950	RBMK	1975	1979	1983
Kalininskaja-1	Ka AES-1	Kalinin	Udomlja Lake	1000/953	VVER	1974	1978	1983
Kalininskaja-2	Ka AES-2	Kalinin	Udomlja Lake	1000/953	VVER	1974	1979	1984
Kol'skaja-3	K AES-3	Murmansk (Polyarnye Zori)	Imandra Lake	440/420	VVER	1975	1979	1982
Kol'skaja-4	K AES-4	Murmansk (Polyarnye Zori)	Imandra Lake	440/420	VVER	1975	1980	1983
Kurskaja-3	Ku AES-3	Kursk	Sejm	1000/950	RBMK	1975	1980	1983
Kurskaja-4	Ku AES-4	Kursk	Sejm	1000/950	RBMK	1975	1981	1984
Černobyl'skaja-4	Kiev-3 C AES-4 Kiev-4	Černobyl'	Pripjat'	1000/950	RBMK	1975	1981	1983
Južno-Ukrainskaja-1	Ju AES-1 Nicoleav-1 South Ukraine-1 Konstantinovka	Nicolaev	Juznyj Bug	1000/953	VVER	1975	1980	1983
Južno-Ukrainskaja-2	Ju AES-2 Nicoleav-1 South Ukraine-2	Nicolaev	Juznyj Bug	1000/953	VVER	1976	1982	1984
Ignalinskaja-1	Li AES-1	Vil'njus	Drukšaj Lake	1500/1450	RBMK	1977	1982	1984
Ignalinskaja-2	Li AES-2	Vil'njus	Drukšaj Lake	1500/1450	RBMK	1978	1983	1986
Khmel'nickij-1	Kh AES-1	Khmel 'nickij		1000/953	VVER	1977	1984	1985
Khmel'nickij-2	Kh AES-2	Khmel 'nickij		1000/953	VVER	1979	1985	1986
Zaporožskaja-1	Z AES-1	Zaporože	Dnepr	1000/953	VVER	1978	1984	1984
Zaporožskaja-2	Z AES-2	Zaporože	Dnepr	1000/953	VVER	1980	1985	1985
Volgodonsk-1	V AES-1	Tsimljansk	Don	1000/953	VVER	1978	1984	1985
Volgodonsk-2	V AES-2	Tsimljansk	Don	1000/953	VVER	1980	1986	1986
Aktaš-1	Ak AES-1	in Crimea		1000/953	VVER	1978	1984	1985
Balakovo-1	B AES-1	Saratov	Volga	1000/953	VVER	1978	1984	1985
Balakovo-2	B AES-2	Saratov	Volga	1000/953	VVER	1980	1986	1986
Nižnekanskaja-1	Ni AES-1	Mendeleevsk	Kama	1000/953	VVER	1979	1986	1986
Kostroma-1	Ko AES-1	Kostroma area	Volga	1500/1450	RBMK	1981	1986	1986
Odessa-Tuzly-1		Odessa		1000/953	VVER	1980	1985	1987

Source: CEA DPG/GIDE 82-299/J.C. Le Ralle.

TABLE 5.—PLANNED UNITS IN THE SOVIET UNION AS OF 01.01. 1982

Name of station	Other designation	Location	River	Reactor capacity HWe gross/net	Reactor type	Order	Initial operation forecast	Commercial operation forecast
Smolenskaja-3	Sm AES-3	Smolensk	Desna	1000/950	RBMK	1974	1986	1986
Smolenskaja-4	Sm AES-4	Smolensk	Desna	1000/950	RBMK	1974	1987	1987
Kalininskaja-3	Ka AES-3	Kalinin	Udomlja Lake	1000/953	VVER	1974	1988	1989
Kalininskaja-4	Ka AES-4	Kalinin	Udomlja Lake	1000/953	VVER	1974	1989	1990
Južno-Ukrainskaja-3	Nikolaev-3 Ju AES-3 South Ukraine-3	Nikolaev	Južnyj Bug	1000/950	VVER	1974	1985	1987
Južno-Ukrainskaja-4	Nikolaev-4 Ju AES-4 South Ukraine-4	Nikolaev	Južnyj Bug	1000/950	VVER	1974	1986	1988
Ignalinskaja-3	Li AES-3 Ignalin-3	Vil'njus	Drukšaj Lake	1500/1450	RBMK	1976	1985	1989
Ignalinskaja-4	Li AES-4 Ignalin-4	Vil'njus	Drukšaj Lake	1500/1450	RBMK	1976	1985	1989
BN 1600		Obninsk	Protva	1600/1500	Breeder	1977	1989	1990
Khmel'nickij-3	Kh AES-3	Khmel'nickij		1000/953	VVER	1977	1986	1987
Khmel'nickij-4	Kh AES-4	Khmel'nickij		1000/953	VVER	1977	1987	1988
Odessa-Tuzly-2		Odessa		1000/953	VVER	1980	1985	1988
Zaporožckaja-3	Z AES-3	Zaporože	Dnepr	1000/953	VVER	1980	1987	1987
Zaporožckaja-4	Z AES-4	Zaporože	Dnepr	1000/953	VVER	1980	1988	1988
Zaporožckaja-5	Z AES-5	Zaporože	Dnepr	1000/953	VVER	1980	1990	1990
Zaporožckaja-6	Z AES-6	Zaporože	Dnepr	1000/953	VVER	1980	1991	1991
Volgodonskaja-3	V AES-3	Tsimljansk	Don	1000/953	VVER	1981	1988	1988
Volgodonskaja-4	V AES-4	Tsimljansk	Don	1000/953	VVER	1981	1989	1989
Balakovo-3	B AES-3	Saratov	Volga	1000/953	VVER	1980	1987	1987
Balakovo-4	B AES-4	Saratov	Volga	1000/953	VVER	1980	1988	1988
Aktaš-2	Ak AES-2	Crimea		1000/953	VVER	1978	1987	1987
BN 800				800/750	Breeder	1979	1991	1991
Rovenskaja-3	Ro AES-3 Ukraine-3	Kuzneccovsk	Styr	1000/953	VVER	1979	1985	1986
Rovenskaja-4	Ro AES-4 Ukraine-4	Kuzneccovsk	Styr	1000/953	VVER	1979	1985	1987
Nižnekamskaja-2	Ni AES-2	Mendeleevsk	Kama	1000/953	VVER	1979	1987	1987
Nižnekamskaja-3	Ni AES-3	Mendeleevsk	Kama	1000/953	VVER	1980	1989	1989

Nižnekamskaja-4	Ni AES-4	Mendeleevsk	Kama	1000/953	VVER	1980	1990	1990
Kostroma-2	Ko AES-2		Volga	1500/1450	RBMK	1981	1987	1987
Kostroma-3	Ko AES-3		Volga	1500/1450	RBMK	1981	1989	1989
Kostroma-4	Ko AES-4		Volga	1500/1450	RBMK	1981	1990	1990
Cernobyl'skaja-5	C AES-5 Kiev-5	Cernobyl'	Pripjat'	1000/950	RBMK	1981	1990	1990
Cernobyl'skaja-6	C AES-6	Cernobyl'	Pripjat'	1000/950	RBMK	1981	1991	1991

Source: CEA DPG/GIDE/82-299/J. C. Le Ralle.

TABLE 6.—GROWTH OF THE SHARE OF ELECTRICITY GENERATED BY NUCLEAR POWER IN THE SOVIET UNION

Year	Nuclear production (in TWh)	Share in total electrical production (in percent)	Total electrical production (in TWh)
1964	0.3	0.06	459
1965	1.4	.28	507
1966	1.7	.39	545
1967	1.8	.36	539
1968	2.9	.45	638
1969	3.3	.48	680
1970	3.5	.47	741
1971	4.0	.50	800
1972	7.3	.85	857
1973	11.6	.70	915
1974	17.6	1.15	976
1975	20.2	1.92	1,038
1976	25.9	2.0	1,111
1977	34.0	2.95	1,152
1978	44.8	3.8	1,202
1979	54.0	4.35	1,239
1980	72.5	5.59	1,295
1981	75.0	5.66	1,325

Sources: Atomwirtschaft, July 1979, p. 369–369 ECRE, vol. 4, no. 2, February 1980, p. 5; vol. 5, no. 2, February 1981, p. 7 Ekonomiceskaja Gazeta, no. 5, January 1982 CEA, DPG/GIDE/82-299/J.C. Le Ralle.

TABLE 7.—STATE OF THE NUCLEAR POWER PROGRAMS AS OF 01.01.1982

Country	Reactor type	In operation	Capacity MWe gross/net	Under Construction	Capacity MWe gross/net	Planned (ordered)		Total	
			Number of units		Number of units	Capacity MWe gross/net	Number of units	Capacity MWe gross/net	Number of units
U.S.S.R.	BWR	62/50	1					62/50	1
	GLWR	648/540	10					648/540	10
	RBMK	9,314/8,842	12	9,500/9,100	8	11,500/11,050	9	30,314/28,992	29
	VVER	5,223/4,896	11	15,880/15,135	17	21,000/20,013	21	42,103/40,044	49
	Breeder	762/696	3			2,400/2,250	2	3,162/2,946	5
Total, U.S.S.R.		16,009/15,024	37	25,380/24,235	25	34,900/33,313	32	76,289/72,572	94
Bulgaria	VVER	1,320/1,215	3	1,440/1,358	2	7,000/6,671	7	9,760/9,244	12
Czechoslovakia	VVER	826/762	2	3,080/2,940	7	7,320/6,978	9	11,226/10,680	18
GDR	VVER	1,840/1,702	5	3,960/2,520	9	1,320/1,260	3	7,120/5,482	17
Hungary	VVER			1,760/1,610	4	4,000/3,812	4	5,760/5,422	8
Poland	VVER			440/408	1	1,440/1,361	2	1,880/1,769	3
Romania	PHWR			685/640	1	685/640	1	1,370/1,280	2
Total, Eastern Europe		3,986/3,679	10	11,365/9,476	24	21,765/10,722	26	37,116/33,877	60
Cuba	VVER			440/410	1	440/410	1	880/820	2
Finland	BWR	1,382/1,320	2					1,382/1,320	2
	VVER	905/862	2			1,000/953	1	1,905/1,815	3
Yugoslavia	PWR	664/632	1					664/632	1

TABLE 8.—SHARE OF ELECTRICITY GENERATED BY NUCLEAR POWER IN EASTERN EUROPE IN 1980

[Estimated figures]

Country	Nuclear production in TWh	Share in total electrical production (in percent)	Total electrical production (in TWh)
Bulgaria	6.2	17.79	34.835
Czechoslovakia	4.5	6.19	72.68
GDR	11.9	12.04	98.78
Hungary			25.8
Poland			121.9
Romania			67.5
Total, Eastern Europe	22.6	5.36	421.495
U.S.S.R.	72.5	5.59	1,295.0
Total	95.1	5.54	1,716.495

Sources: ECPE, Vol. 5, No. 2, February 1981, p. 8. CEA, DPG-GIDE, 82-299, J. C. Le Ralle.

TABLE 9.—EVOLUTION OF THE INSTALLED NUCLEAR CAPACITY BY COUNTRY IN GROSS MWe

[Number of units]

Country	End of year—						
	1954	1960	1965	1970	1975	1980	1981
Bulgaria					880(2)	1,320(3)	1,320(3)
Czechoslovakia					143(1)	[1] 826(2)	826(2)
GDR				80(1)	960(3)	1,840(5)	1,840(5)
Total, Eastern Europe				80(1)	1,983(6)	3,986(10)	3,986(10)
U.S.S.R.	6(1)	406(5)	1,054(10)	1,631(13)	5,625(22)	14,569(35)	16,009(31)
Total	6(1)	406(5)	1,054(10)	1,711(14)	7,608(28)	18,555(45)	19,995(47)

[1] The Czech A-1 station (143 MWe) was shutdown in 1977.

TABLE 10.—PROJECTION OF THE INSTALLED NUCLEAR CAPACITY THROUGH 1990, AS OF JAN. 1, 1982

Country	End of year—						
	1981	1982	1983	1984	1985	1990 probable	1990 objective [1]
Bulgaria	1,320(3)	1,760(4)	1,760(4)	1,760(4)	1,760(4)	4,760(7)	4,760
Czechoslovakia	826(2)	826(2)	1,266(3)	2,586(6)	3,466(8)	7,226(14)	7,280
GDR	1,840(5)	2,280(6)	3,160(8)	4,040(10)	4,920(12)	7,120(17)	9,360
Hungary		440(1)	880(2)	1,320(3)	1,760(4)	2,760(5)	2,760
Poland						880(2)	4,880
Romania					685(1)	1,370(2)	4,110
Total, Eastern Europe	3,986(10)	5,306(13)	7,066(17)	9,706(23)	12,591(29)	24,116(47)	[2] 37,000
U.S.S.R.	16,009(37)	16,449(38)	22,889(45)	28,389(50)	33,389(55)	71,489(89)	[3] 80,000
Cuba						880(2)	1,320
Total, CMEA	19,995(47)	21,755(51)	29,955(62)	38,095(73)	45,980(84)	95,485(138)	130,000
Finland	2,287(4)	2,287(4)	2,287(4)	2,287(4)	2,287(4)	3,287(5)	3,287
Yugoslavia		664(1)	664(1)	664(1)	664(1)	664(1)	1,328

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[1] Figures in this column are cited as the global objectives of each country and do not always correspond to the total obtained by aggregating the planned units. These objectives are discussed in the sections relative to each country.
[2] Although 37,000 MWe is still cited as the overall objective, it is noteworthy that the total obtained by adding the objectives of the individual countries does not exceed 33,150 MWe.
[3] The objective actually ranges from 80,000 MWe to 120,000 MWe depending on the source.

By 1975, nine new reactors were commissioned (see table 2); among them, the first two 1000 MWe of the RBMK type near Leningrad and a fast breeder reactor, BN 350, in Ševčenko at the Caspian Sea. Thus the total installed capacity was 5,625 MWe, less than the original projection, or the revised one of 6,200 MWe, representing a share of 1.92 percent (see table 6). Plans for 1980 were reduced to 19,400 MWe [48] and again in 1977 to 13,000 MWe.

The development of fast breeder reactors is considered by the Soviets as the "second phase of the development of nuclear power" and as the solution to the problem of the exhaustion of uranium reserves. During the Xth FYP "all the technical and economic problems should be solved" and large capacities are envisaged.[49]

Among the goals of the Xth FYP, Atommaš has a decisive place for the realization of the current and future nuclear power programs in the Soviet Union and Eastern Europe. Construction work on Atommaš was undertaken at the beginning of 1975.[50]

When operating at projected capacity, Atommaš will be the most important production center of nuclear equipment in the world. It will produce the different components of all types of Soviet reactors and in a first period the VVER-1000 on an assembly-line basis.[51] Its geographic situation in Volgodonsk (near Volgograd) on the Don near the Volga-Don canal will permit water transport of the equipment along the Don, the Dniepr, the Dnestr and the Danube rivers, serving the regions where most of the new stations will be erected. According to the initial plans, the first three VVER-1000 were to be delivered in June 1978 and eight reactors were to be dispatched yearly beginning in 1980.

Soviet reactor exports to Eastern Europe

The Soviet Union signed agreements with several East European countries for export of reactors to them with the expectation that the stations to which they were assigned would be operational by 1980.

These agreements served several purposes. Primarily they advanced the long term objective of the Soviet Union for the integration of East Europe. The installation of the 440 MWe reactors constituted a test of the feasibility of exporting them not only to CMEA countries but (because of their relatively modest size) to developing countries as well.

Agreements were actually concluded with Finland for two VVER-440 in 1970 (brought into operation in 1977 and 1981, respectively) and a VVER-1000 in 1977 [52] (see appendix 9). The interesting aspect of these agreements consists of the modifications included in the Soviet design and the resulting collaboration between the Soviet Union and several West European countries.[53]

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[48] On a total increment of 67,000 to 70,000 MWe of installed capacity, 13,000 to 15,000 MWe were to be nuclear power plants. These figures were set forth in the "Basic Orientations for the Development of the National Economy of the USSR in the 1976-1980 period". Neporožny, Minister of Energy and Electrification announced in his speach before the Congress slightly higher figures: "at least 70,000 MWe of new installed capacity, of which at least 15,000 MWe are of nuclear origin", Atomnaja Energija, vol. 40, No. 5, May 1976, pp. 363-366.

[49] A. M. Petros'janc (1977), Problèmes actuels des sciences et techniques nucléaires en URSS, (translation of the Russian 3rd Edition), p. 574.

Research on the fast breeder reactors started in 1948. By the end of the 1960's several prototypes were installed, BR 5 in Obninsk, BOR 60 in Dimitrovgrad in 1969, BN 350 in Ševčenko in 1973, BN 600 near Sverdlovsk in 1980. Two others are envisaged: a BN 800 and a BN 1600. The latter is seen as the prototype for future industrial development and will be of the "integrated system" (the reactor core, the pumps and the intermediate heat exchangers are within the reactor housing, as opposed to the "channel" type for which they are not.)

[50] Izvestija, Mar. 2, 1978.

[51] L. V. Timofeev (1977), pp. 420-422.

Czechoslovakia.—In April 1970 Czechoslovakia signed an agreement with the Soviet Union involving the delivery of two reactors for the Jaslovske Bohunice station.[54] Design preparation was carried out jointly by Energoprojekt Prague, the general developer, and Leningrad Division Teploelektroproekt, the Soviet designer. The Soviet Union supplied the primary system components and the Skoda Plzen Works manufactured the equipment for the secondary system.[55] The first unit was commissioned in 1978 and the second in 1980.

In 1973 an agreement apparently required the Soviet Union to deliver parts for two additional units.[56] This agreement does not appear to have been carried out for a new one in 1976 called for the Skoda Works to manufacture the two units.[57]

In an interim an agreement signed in 1974 Czechoslovakia was to undertake manufacture of 440 MWe reactors at the Skoda Works.[58] The confidence in its own capacity to do so arose rather ironically. The stage two agreement for the cooperative construction of the A-1 station, it will be recalled, was abandoned by the Soviet Union, which did not deliver either the promised reactor or the assistance that had been agreed upon. Nevertheless the reactor was completed in 1972 some sixteen years after the original agreement. To accomplish this, Czechoslovakia had to engage in independent research and develop the capacity to manufacture necessary parts. Sectors of its industry were converted to nuclear research and the slow and rather tedious process of qualifying for manufacturing. The expertise so acquired was presumably the basis for the confidence to undertake manufacture of 440 MWe reactors.

Also included in the plans for 1980 was the construction of a second nuclear power station at Dukovany to be built entirely by Czech enterprises. Thus a total capacity of 2,640 MWe, of which Czechoslovakia was to provide 1,760 MWe, was planned for 1980 (see appendix 3).

East Germany.—Construction work on the East German station, Bruno Leuschner on the Baltic Sea (generally referred to as Nord) for which two VVER reactors were ordered from the Soviet Union in 1965 was not begun until 1969–1970, and completed in 1974–1975. Two additional units were ordered in 1973, to be completed before 1980; and eight more were ordered for another station, Magdeburg. It would appear that this agreement was not implemented, for another one, signed in April 1980, involved the construction of the same station [59] (see appendix 4).

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[52] Nuclear News, vol. 20, No. 3, October 1977.

[53] The Soviet Union delivered the heavy reactor components and turbogenerators while the Finnish electric utility, Imatran Voima Oy was responsible for the mechanical and electrical equipment. In view of the safety regulations established by western countries, Finland decided to include a Westinghouse ice condensor system for the containment barrier and surveillance and control equipment from Siemens. West Germany also supplied certain other parts and Great Britain, the computers. Ivo Consulting Engineers, a subsidiary of Imatran Voima, in collaboration with Switzerland's Elektrowatt played a major role in the architectural and structural design and layout of the plant including the coordination and administration of the project. Six hundred Soviet specialists were on the site for construction work. D. Lavrenčič (1977), p. 44; Nuclear News, vol. 20, No. 3, October 1977; ECPE, vol. 5, No. 6, June 1981, p. 23; Ekonomičeskaja Gazeta, No. 46, 13–19 November 1978.

[54] H. Drozd (1980), pp. 49–50.

[55] Ibid.

[56] CEA, op. cit.

[57] H. Drozd (1980), p. 49.

[58] J. M. Kramer (1979), p. 947 and M. Rostocki, p. 55.

Thus total planned installed capacity for 1980 amounted to 3,600 MWe, placing the GDR in the forefront of the ECMEA (see tables 6 and 9).

Bulgaria.—In Bulgaria, the two units ordered from the Soviet Union in 1966 were put into operation in 1974 and 1975 according to plan. Plans for 1980 called for the construction of two additional units thus raising the total capacity to 1,760 MWe (see appendix 2).

Hungary.—The 1966 agreements promising Hungary for delivery of two reactors by 1975 was not honored. The plans for the reactor were delayed largely owing to Hungary's financial straits. Finally the reactor was ordered from Czechoslovakia.

Romania.—Romania concluded an agreement with the Soviet Union in 1970 for the construction of a 440 MWe VVER type of reactor near Pitesti on the Olt River to be completed by 1980. However, the project was postponed to 1975 and subsequently probably cancelled.[60] The reasons were never set forth. The Soviet press still mentions the Olt station but it has not been cited by the Romanian press since approximately 1975.

It appears that not having arrived at a definite agreement with any western manufacturer, Romania signed the Olt agreement with the Soviet Union. Nevertheless, it continued searching for a PHWR reactor. Romania was still a net exporter of conventional energy in 1970 and had no urgent immediate need for nuclear power.

Demand for installed capacity between 1970 and 1980, represented by the orders of CMEA members placed with the Soviet Union, amounted to 7480 MWe; including Finland's the total would be 8385 MWe. In terms of reactor units the number is 19, of which the Soviet Union delivered 11 on schedule.

In view of the chronic absence of specific information, the reasons for non-delivery of the remaining 8 units must be hypothesized. A partial reason could have been differing domestic policies of the individual countries involved. Another, is simply that the Soviet Union was physically unable to do so. In the cases of the four Magdeburg units, delivery was postponed by the GDR authorities. Indeed when construction of the Magdeburg station was announced in 1980, there was no mention of a previous agreement with the Soviet Union. Romania finally decided on western technology and probably cancelled its orders with the Soviet Union. The last Bulgarian unit should come on line presently, two years beyond schedule. Finally the two units destined for Hungary were re-scheduled and ordered from Czechoslovakia in 1976.

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[59] Neues Deutschland, GDR-Berlin, January 17/18, 1981; Notizario Comitato per l'Energia Nucleare, May 1980, pp. 17–18.

[60] According to Canadian sources (AECL), work on the Olt station has never started, in Nuclear News, vol. 22, No. 2, February 1979, p. 5.

The role of the CMEA in the East European nuclear power industry

Beginning in 1970 the efforts of the CMEA countries in the production of electrical energy by nuclear power became a major priority and hence took on an intensively organized, systematic and comparatively formed character as will be seen in the following outline of actions taken.

1971

A Comprehensive Program for the Development of Socialist Integration (including conventional and nuclear energy) was adopted for the succeeding 15–20 years.[61]

1972

The XXVIth Session of the CMEA in Warsaw recommended that the members coordinate their plans for the 1976–80 period.

Three Standing Commissions—Machine Construction, Electrical Energy, and Nuclear Energy—formed a working group to study the specific energy objectives of the Comprehensive Program.

Under SCAE, seven Councils for Scientific and Technological Cooperation are created. Responsibility for the Councils is assigned as follows: Romania, research in reactors; Czechoslovakia, fuel reprocessing; GDR, water purification systems and protection against radiation exposure; USSR, development of fast breeder reactors, treatment and storage of radioactive waste, research in radiation technology.

Interatominstrument—a legally autonomous, international organization is created in the context of the Comprehensive Program by the USSR and all European members, except Romania with headquarters in Warsaw. Composed of 15 producers of technical nuclear equipment and trade organizations of the six countries, its purpose is the coordination of scientific, technical and economic collaboration in the production of components and machinery destined for nuclear power plants as well as for centers engaged in the application of nuclear research in such areas as radioactive isotopes in physics and medicine. Production under the aegis of Interatominstrument is according to Soviet specifications.[62]

Management of Interatominstrument is by a Council composed of representatives of each country in the association. The Council approves annual and long term plans. Three subsidiaries, Pleven in Bulgaria, Zielona Gora in Poland, and Dubna in the USSR, provide local ancillary services. Production subsidiaries are planned.[63]

1973

Interatomenergo, an international economic association located in Moscow was founded by the CMEA membership and Yugoslavia to coordinate all activities concerning the development of nuclear energy. For construction of nuclear power plants supervision was previously provided by Atomenergoeksport. Each country is represented by membership of the appropriate national enterprises.[64]

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[61] "Comprehensive Program Tending to Deepen and Improve Cooperation and Develop the Socialist Economic Integration", XXVth Session of the CMEA, July 1971.

[62] M. Lavigne (1979), p. 355.

[63] "CMEA Cooperation in Nuclear Instruments Outlined", AW DDR Aussenwirtschaft, No. 49, December 7, 1977 in JPRS, No. 1718, January 26, 1978, p. 3.

Integration of nuclear programs and collaboration among member countries is possible as the consequence of a standardization project for nuclear plants equipped with pressurized water reactors. One of the first actions of Interatomenergo was to assign to each country its construction, in terms of its capacity to contribute, according to the specialization and cooperation agreement signed in 1979 for the 1981–90 period.[65]

Interatominstrument and Interatomenergo are the executive organs for the implementation of the recommendations of the Commissions as of the agreements between the several countries.

1975

In 1975, a "Concerted Plan of Multilateral Integration Measures" was adopted for the 1976–1980 period. It was the first concrete integration plan directed to specific projects in the field of energy. Among these projects was the connection of the East European integrated power system with the European grid of the USSR via a 750 kV line including the nuclear power plants under construction.

According to the plan, equipment and supplies for nuclear installations during the 1976–1980 period would be based on the bilateral agreements and in particular those with the Soviet foreign trade organization, Atomenergoeksport. Poland was to manufacture the steam generators; the GDR, the instruments and voltage regulators; and Hungary was to provide the devices for the treatment of water from the primary and secondary systems, as well as the pumps and automated equipment.

1978

The nuclear program was also included in two of the five "Long-term Target Programs of Cooperation". The Energy, Fuel and Raw Materials Program focuses on the development of nuclear power to the year 1990 and the Machine Construction program attaches special significance to the production of equipment for nuclear power plants. These two programs were organized in 1978 and serve as guidelines for the bilateral and multilateral specialization agreements signed the next year.

As in previous periods it is obvious that the Soviet Union continues to maintain virtually total control over CMEA's nuclear program. Agencies created by the CMEA which by their functions might be considered to be empowered to make discretionary decisions are rendered impotent since endowed with powers of recommendation only and, in any event, chaired by a Soviet representative.

In the period under consideration the nuclear program was at a point of development at which manufacture of reactors, the construction of power stations and related matters had moved ahead of research in the order of priority. The primary requirement was for administrative rather than scientific or technological expertise. Indeed the decisions regarding specialization of function, the creation of the appropriate coordination and supervision agencies of the specialized responsibilities were of an essentially functional nature. The purposes of the program might perhaps have been satisfactorily carried out by the administration agencies created. Thus the establishment of Interatomenergo and Interatominstrument may be regarded as control agencies of a more sophisticated sort than those employed at earlier stages of the program.

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[64] Among them: Bulgaria's Commissariat for Heavy Machine Building, Hungary's enterprise "Khimimash", the East German combine "Kraftswerksanlagenbau", the Polish association "Megat", the Romanian Heavy Machine Factory, the Czech enterprise "Skoda" and the all-Union association "Sojuzglavzagranatomenergo". P. Josephson (1981), p. 6.

[65] K. Bossanyi (1980), p. 12.

ACHIEVEMENTS AND FUTURE PROSPECTS

Between 1970 and 1980, the nuclear program developed rapidly. The CMEA increased its total installed capacity from 1,711 MWe to 18,555 MWe or by a factor of approximately 10.8. The Soviet Union alone moved from 1,631 MWe to 14,569 MWe or an increase of a factor of 8.9. By 1982, the CMEA reached 19,995 MWe and the Soviet Union, 16,009 MWe. Results in Bulgaria, Czechoslovakia and the GDR are not negligible; the increase from 80 MWe in 1970 to 3,986 MWe by the end of the decade represents an increase by a factor of 49.8 (see tables 9 and 10). Furthermore, the planned rate of growth through 1990 will continue to increase as larger capacities (1000-1500 MWe) will be commissioned and Atommaš and the Skoda Works will be fully operational. Multilateral cooperation within the framework of the CMEA was intensified during this period, the culmination of which was the signing of the specialization agreement in 1979 and the decision to undertake specific joint projects.

Soviet plans for nuclear power in the 1980's

By the end of the Xth FYP, the total capacity in the Soviet Union amounted to 14,569 MWe (see table 9), representing a share of 5.59 percent (see table 6).

The goals of the XIth FYP call for a total electricity production of 1550-1600 TWh of which 220-225 TWh or about 14 percent should be generated by nuclear power. In the European part of the country, nuclear power stations will account for the entire planned increase in production. Additional nuclear capacity to be installed amounts to 24 to 25,000 MWe which added to existing capacity at the beginning of the plan means a total of 38,000 MWe by the end of the plan.[66]

In an effort to achieve these goals, 25 units are now under construction, amounting to a total capacity of 25,380 MWe (see table 4 and 7). All will be located in the European part of the USSR and are projected to be commissioned by 1985.

Plans for 1990 vary, depending on the source, from 80,000 MWe to 110,000 MWe of installed nuclear capacity. An additional capacity of about 35,000 MWe would be required to meet the lower target.[67] Units to fulfill this goal have already been ordered (see

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[66] "Basic Guidelines for the Economic and Social Development of the USSR in 1981-1985 and the period up to 1990"., Pravda, March 5, 1981, pp. 1-7.

[67] P.S. Neporožny in 1978 cited 100,000 MWe, Izvestija, December 1, 1978 p. 4; he also announced in 1981 that 10,000 MWe per year were to be installed during the X11th FYP. This

Continued

table 5 and 7). Little is known about their dates of completion besides being expected before 1990.

Finally, about 15 stations are planned for the years beyond 1990. Very little information is available of their location or their scheduled completion.

The greatest number of units is of the VVER type. However, in view of the Soviet project to upgrade the RBMK units to a capacity of 2000 to 2400 MWe, it seems likely that they will be predominant over the long term. As for the VVER-1000, it is mainly destined for export.

The advantage of the VVER is that they cost relatively less—in 1977, 30 percent less than a RBMK of same capacity—and that they use ordinary water as moderator and coolant. Their disadvantage is that the loading of the fuel requires the shutdown of the reactor (whereas the RBMK does not); one third of the fuel rods are renewed every year and so the reactors are shutdown approximately 26 days per year. The Soviet Union does not seem to be envisaging the development of reactors with a capacity exceeding 1000 MWe mainly because of the transport problem of the reactor vessel. However, it does not exclude the possibility of designing prefabricated sections which would allow easier transport and assembly on the site (one of the advantages of the RBMK).

The inclusion of containment vessels around the reactors is in order to fulfill western safety requirements and indicates that the Soviet Union is hoping to export such reactors not only to Eastern Europe but also to western countries.

Construction work on Atommaš encountered numerous difficulties and is several years behind. To date, only one of its production lines has been opened. The first reactor body was completed in February 1981 and delivered to the Južno-Ukrainskaja station.[68]

Current plans call for Atommaš to produce seven more reactors during the XIth FYP, of which the first four are destined to the Khmel'nickij station (a joint project of the CMEA).[69] In other words, if no additional delays occur, the plant will have produced eight reactors by the end of this FYP instead of the 43 that should have been produced if the original plans had been fulfilled. It is probable that the rate of production of eight reactors yearly will not be attained before the XIIth FYP, or even the 1990's.

Since Atommaš will produce only VVER-1000, the production of RBMK reactors will continue in the Ižorskij Plant Production Association (near Leningrad). It is the second most important construction plant after Atommaš and has been producing power equipment since 1964. In addition to the RBMK reactors, it produced all the components of the primary system of the VVER-440[70] until most of the production was turned over to Czechoslovakia and all the VVER-1000 built to this day (Novo-Voronež-5 and the ones to be installed in the Južno-Ukrainskaja station).[71] The prototypes of

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brings the figure to 130,000 MWe approximately. However, by adding the units under construction and planned for the same date, the installed capacity obtained does not exceed 71,489 (see table).

[68] Pravda, February 20,1981.

[69] V. G. Peršin (General Manager of Atommaš and also Deputy Minister of Power Industry Machine Building), Ekonomičeskaja Gazeta, No. 1, January 4, 1981.

[70] Technology and Soviet Energy Availability, (1981), p. 116.

[71] Ekonomičeskaja Gazeta, No. 29, 16–24 July 1979; Socialističeskaja Industrija, November 15, 1979; Pravda, November 17, 1979.

the equipment that will then be produced on a large scale in Atommaš will also be built in Ižora.[72]

By simple arithmetic it appears that if Atommaš produces—at the best—seven reactors during the XIth FYP, three other VVER-1000 will have to be produced at the Ižorskij plant. During the XIIth FYP Atommaš would have to manufacture 6 to 7 reactors yearly to meet the 33 reactors that are planned, of which 10 are to be delivered to Eastern Europe. Such a turn out being most improbable, the Ižorskij plant will therefore have to continue producing VVER-1000 at least until 1990. By then the Skoda Works should take over.[73]

In other words it is obvious that the Soviet plans will have to be subject to drastic reduction as they have been in the recent past.

East European plans for nuclear power in the 1980's

Czechoslovakia.—Presently, Czechoslovakia has only the first two units at Bohunice in operation. The four units ordered from Skoda and expected for 1980 are now expected between 1983 and 1984. Thus, despite a quite early start, the pace of development was very slow during this past decade.

Furthermore, the A-1 station was shutdown in February 1977 for "fuel loading, maintenance and repair".[74] Apparently a fuel rod was damaged while the reactor was being loaded.[75] The "Charter 77" released a document in November 1977 explaining that on February 24, 1977 an emission of carbon bioxide had occurred and that the station had been shut down as a result of "serious problems".[76] It is noteworthy that only recently the plant was recognized "officially" as no longer producing electricity.[77] However, it is still referred to as being the "largest scientific research center of Czechoslovakia" and no mention is made of the problems encountered.[78]

In contrast to with these poor results, the plans for the two forthcoming FYP rely heavily on nuclear energy for the development of electric production in order to limit Czechoslovakia's imports of oil.

The total increase in generation of electric power during the period until 1985 will amount to 15 TWh of which nuclear power plants will produce 12.7 TWh, or about 85 percent.[79] In order to fulfill this goal 2640 MWe should be installed, bringing the total capacity to 3,466 MWe (see table 10).

The objectives for 1990 include another station, Mochovce composed of four 440 units and two 1000 MWe units on the site of Malovice (see appendix 3). In other words a total capacity of 7,280 MWe is planned (previous plans stated 10,280 MWe, including two more VVER-1000).[80]

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[72] Ekonomičeskaja Gazeta, op. cit. p. 9.

[73] Technology and Soviet Energy Availability, discusses the Soviet Union's ability to meet the 1990 targets, pp. 121-132.

[74] IAEA Bulletin, 1977.

[75] "New Nuclear Power Plants in Europe, 1979" op. cit., p. 7.

[76] Ibid.

[77] M. Durisinova, "The First Year of the Atomic Age and What Next", Lidove Demokracie, November 22, 1980, in JPRS, No. 76972, December 10, 1980, p. 21.

[78] A. M. Petros' Janc (1981), p. 199. Statisticka Rocenka CSSSR, Jahrbuch des Aussenhandels der Tschechoslovakei, 1981.

[79] V. Farka and S. Kain, "Magnificient Vistas", Hospodarske Noviny, September 19, 1980, p. 1-11, in JPRS No. 76822, November 14, 1980, pp. 16-21.

[80] V. Ehrenberger, Energetika, No. 1, January 1981. The figures in Table 10 indicate 7,226 MWe the two first units of Bohunice only have a capacity of 413 MWe (see appendix 3).

Judging by its rate of growth the Czech nuclear program is the most ambitious of all the CMEA countries (see table 10). The challenge posed by the construction of six units is evident considering the short-falls which have occurred so far and the limited results of the previous FYP.

Among the reasons invoked for the delays, the most frequent remains the chronic shortage of labor. Though repeatedly dealt with by the Czechoslovak authorities and measures adopted the problem generally remains. Delays in the deliveries of equipment for main and auxiliary structures of the power plant are also often stressed.[81]

It seems that the Skoda Works also has been experiencing problems since the decision to produce VVER 440 in the mid-70s. The first unit, dispatched from Skoda in July 1981, was destined for the Paks station in Hungary.[82] During this decade it is supposed to produce 17-18 440 VVER reactors of which 7 or 8 are to be exported to Eastern Europe. Of these, two are for the Paks station, two for the German Nord station and presumably three for the Soviet Union.[83]

In January 1980 Skoda announced that six reactors were under construction and four in metallurgical stage. Since the construction takes about three years, no reactor is to be expected until 1983 and it is doubtful that Skoda will be able to produce 17 reactors by 1990.[84]

Skoda is also scheduled to produce nine VVER-1000 reactors Three are for Czechoslovakia, the rest for the other CMEA countries. The delivery of the first 1000 MWe reactor was postponed from 1985 to 1987 and it will probably be delayed again to 1990. Skoda is also envisaging work on fast breeder reactors after 1990.[85]

In 1980, a long term cooperation agreement was signed between the Soviet Union and Czechoslovakia providing for cooperation in the manufacture of equipment for 440 and 1000 MWe nuclear power plants until 1990, in particular for the construction of the Dukovany and Mochovce power plants.[86]

East Germany.—The GDR presently has the largest nuclear capacity of Eastern Europe outside the Soviet Union. Its five units represent a total capacity of 1840 MWe (about half of the 3600 MWe originally planned). The electricity produced in 1980 by nuclear power stations amounted to 11.9 TWh, i.e. 12 percent of the total generation of electricity in the country—the highest rate in Eastern Europe after Bulgaria's (see table 8). During the next decade the share of nuclear power should reach 15-20 percent,[87] the installed capacity increasing from 1840 MWe at the end of 1980 to 7,120 MWe in 1990 (see table 10).

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[81] A. Srodos et al., "The Nuclear Power Plant must not be affected by Vacations; Fulfillment of the Task is Realistic Despite Difficulties", Pravda. Bratislava, July 16, 1981 p. 3, in JPRS No. 79125, October 2, 1981, p. 7-8; Rude Pravo, May 20, 1981.

[82] Nepszabadsaq, July 3, 1981.

[83] Czechoslovak Foreign Trade, No. 7, 1981; "The Skoda Plant's Nuclear Future", Lidova Demokracie, February 29, 1980, p. 3, in JPRS No. 75392, March 28, 1980, p. 58.

[84] M. Rostocki (1980).

[85] Zarja Vostoka, Tbilisi, May 6, 1981.

[86] Rude Pravo, November 29, 1980, p. 1; Pravda, June 19, 1980, p. 1.

[87] ECPE, vol. 4, No. 4, April 1980, p. 5.

Four more units are under construction at the Nord station and four at the Magdeburg station for which a new agreement was reached in April 1980. All these units should be commissioned by 1985. The next four units of Magdeburg may be 1000 MWe reactors instead of 440 as originally planned[88] which increases the 1990 projections to a capacity of 9360 MWe.[89]

Nevertheless of the 9360 MWe, more than half will be generated by twelve 440 MWe units. Unlike other East European countries, the GDR seems to have deferred the construction of 1000 MWe units (see appendix 4).

It might seem contradictory that the country which has consistently kept up with development in the Soviet Union and most quickly adapted to new circumstances is in this instance lagging in the acceptance of advanced reactors. But this could also be a clever ploy to insure its scheduled performance without having to rely on the Soviet Union for the delivery of 1000 MWe reactors.

In the framework of the CMEA's Comprehensive Program, the GDR concentrates on the pressurized water reactor and, with the Soviet Union, at the forefront of research on the fast sodium breeder. The GDR also plays an important role in the CMEA in the training of engineers and workers for the construction of nuclear power plants. Special sections were created at the Zittau Advanced School for Engineering and at the Dresden Technical University which are equipped with experimental reactors. A training center is also functioning at the Rheinsberg AKW-1 plant which serves for training specialists coming from other East European countries.[90]

Bulgaria.—In terms of installed capacity Bulgaria stands right behind the GDR and Czechoslovakia with 1320 MWe at the end of 1980 but the share of nuclear power in the total generation of electricity is the highest of Eastern Europe, amounting to 18 percent (see table 8).

The fourth unit of the Kozloduj station is expected in 1982 and four 1000 MWe units were ordered in 1979 to be installed at the same site by 1995. Bulgaria should receive the first VVER 1000 erected outside the USSR; construction work began in 1980 (see appendix 2).[91] These units will bring the installed capacity to 5,760 MWe by 1995 and account for 50 percent of Bulgaria's total electricity production.[92] Nuclear power generation will thus increase from approximately 7.8 TWh in 1981 to 23 TWh in 1990 which corresponds to the total amount of electricity produced by the country in 1974.

The site of Belene was approved in April 1981 for a second nuclear power station. Planned for 1995, it will be composed of four 1000 MWe units of the VVER type.[93]

However, Bulgaria still lacks the necessary infrastructure for installing the power plants. The Soviet Union has thus been obliged to furnish Bulgaria with the construction of facilities, equipment, as well as scientific and technical assistance of specialists on site.

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[88] "New Nuclear Power Plants in Europe, 1979", Atomwirtschaft-Atomtechnik, vol. 4, No. 5, May 1979, in J.P.R.S., No. 1907, June 18, 1979, pp. 1-10; Horizont, GDR-Berlin, No. 15, 1981.

[89] Horizont, No. 15, 1981.

[90] K. F. Alexander (1980), pp. 33-37.

[91] Applied Atomics, No. 1286, June 1980, p. 3.

[92] Revue Générale Nucléaire, September-October, 1979, p. 536; ECPE, vol. 5, No. 1, January 1981, p. 23.

[93] Zemedelsko Zname, Sofia, April 7, 1981, p. 3, in JPRS No. 78042, May 11, 1981.

Hungary.—Hungary's first VVER reactor was originally planned for the end of 1980. The reactor vessel was manufactured by Czechoslovakia—the first one to be produced by Skoda—and dispatched to Hungary in July 1981.[94] It was expected to come on line early 1982.

Among the CMEA countries, Hungary is one of the last to be equipped with nuclear power stations. Nevertheless Hungarian plans are ambitious. A second unit is planned for 1983 and Czechoslovakia has agreed just recently to deliver two complete VVER 440 for Paks 3 and 4 by 1985. In addition four VVER 1000 are planned for the 1990's. This will raise the total installed capacity to 5,760 MWe by 1995 (see appendix 5 and table 10).

The Hungarian nuclear power program is jointly planned by the Soviet organization Teploelektroproect (TEP), the Hungarian Enterprise for Planning of Nuclear Power Stations and the Electric Network (ERTERV). Construction is coordinated by the Hungarian Enterprise for Investments in Nuclear Power Stations (ERBE) and its Soviet counterpart for foreign trade Atomenergoeksport. Construction and assembly work was undertaken by the Hungarian firm (Magyar Villamos Murek Troszt),[95] their share amounts to 30 percent of the work. The Polish firm Budostal is contributing to the construction work, and the GDR and Bulgaria are also supplying some equipment.

Failure to meet the schedule for Paks-1 was largely due to the delay in the delivery of the reactor vessel but other difficulties such as labor and capital cost contributed to it.[96]

Despite a labor force of 11,000 people working on the site, including specialists from Czechoslovakia, Poland, the GDR and the USSR, there is a lack of skilled workers (although 1,000 were sent to the GDR for training). The authorities have difficulty inducing workers to settle in Paks where living conditions are mediocre.[97]

Despite its inability to fulfill the goals set in the early 1970s, Hungary has not revised its program and maintains the ambitious figure of 12,000 MWe of installed capacity by the year 2000.[98] Nuclear power generation should then cover 50 percent of its electric needs.[99]

Poland.—Poland is the least advanced of the East European countries in the development of nuclear power. The implementation of its program has been slow to start and delayed several times. Its economic crisis and political turmoil are added difficulties.

Relying for a long time on its large resources in coal and lignite, Poland has had to depend only recently on the Soviet Union for oil and gas. However, its lack of hard currency will make it virtually impossible for it to sustain deliveries from the Soviet Union. As a result, Poland hopes that by 1990 nuclear energy will cover the increment of energy demand while the bulk of electric energy will still be produced by coal-fired plants.

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[94] Nepszabadasq, July 3, 1981.

[95] "New Nuclear Power Plants in Europe, 1979", op. cit., p. 9.

[96] Initial construction costs, planned at 50 billion forints, were exceeded by at least another 30 billion. In 1979, in order to accelerate the construction work, more than half (i.e. 7 billion forints) of the total expenditures for energy production were invested, two of which were spent just on the main building. E. Szabo interviewed in Nepszabadsaq, March 9, 1980, p. 5, in JPRS, No. 75500, April 15, 1980, p. 27-33; Trybuna Ludu, December 31, 1980 and January 1, 1981; Magyar Newzet, January 6, 1980.

[97] ECPE, vol. 3, No. 2, January 17, 1979.

[98] ECPE, vol. 4, No. 4, April 1980, p. 5.

[99] Revue Générale Nucléaire, September 1979, p. 536; Nucleonics Week, March 13, 1980.

Consequently, Poland sketched out an ambitious nuclear program in 1975 setting a goal of 8,500 MWe by 1990 [100] and 23,000 MWe by the year 2000 [101] and concluded an agreement with the Soviet Union for the construction of two nuclear power plants one in Zarnowiec near Gdansk and the other in the vicinity of Ciechocinek. An agreement between Teploelektroproekt and the Polish Energoproekt was signed in April 1977 for the delivery of Soviet equipment. The Soviet Union is supposed to supply the reactor and certain main assemblies and components while the conventional part of the plant will be of Polish design.[102] They were to be completed by 1990 to achieve a combined target capacity of 6,000 MWe and to enable Poland to conserve 18 million tons of hard coal a year.

These plans were a total failure; the scheduling for the delivery of the Soviet equipment is still being discussed.[103] In 1979, the forecasts for 1990 were reduced to an installed capacity of 4,800 MWe—a cut of almost 50 percent.[104]

Two possible variants of the nuclear power program to the year 2000 have recently been worked out.[105] The first—more conservative—envisages the implementation of Zarnowiec with four 440 MWe units, Kujawy near Ciechocinek and the Warta power plant both with a capacity of 4,000 MWe. This represents a total of 9760 MWe. The second variant projects, in addition, the construction of a 4,000 MWe plant in Malkinia or in the environs of Kadyny on the Wysla Bay which bring it to a total of 13,760 MWe. Considering that the first 1,000 MWe unit will not come on line before 1991, the first variant seems to be the maximum that can be expected by the turn of the century.

Poland's involvement in the CMEA in the nuclear field is quite extensive. Its ability to meet its commitments, however, is questionable. The Polish authorities admit to the fact that part of it will be impossible to deliver within schedule but also feel that if they do not it will be to their own detriment.[106]

In the framework of the CMEA cooperative agreements Polish enterprises are participating in the construction of three nuclear power stations in the Soviet Union.[107] The number of specialists involved amounts to about 4,550 for the peak construction period 1981-1983. In return for Polish labor and deliveries of machinery and equipment, the USSR will provide Poland with about 100 TWh of electricity during the 1984-2003 period.[108]

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[100] Revue Générale Nucléaire, January-February 1977, p. 63.

[101] ECPE, vol. 4, No. 4, April 1980, p. 5.

[102] Revue Générale Nucléaire, op. cit., p. 63.

[103] PAP News Agency, Warsaw, October 22, 1981.

[104] Revue Générale Nucléaire, September-October, 1979, p. 536.

[105] M. Dymczak, "A Nuclear Power Plant in Kadyny?", Glos Wybrzeza, November 4, 1981, p. 3, in JPRS No. 79787, January 5, 1982, pp. 12–15.

[106] Poland was supposed to deliver during the 1981–1985 period equipment for a combined value of 800 million rubles to the CMEA; and during the next FYP deliveries valued at 1.2 billion rubles were to be implemented. The equipment involves nuclear electronic systems (manufactured in the Polon plant), heat exchangers (Sosnowiec Fakop plant) and special stainless steel fittings (Kielce Chemar plant), Ibid., pp. 13–14.

[107] The enterprises are: The Amalgamated Industrial Construction Enterprises of Cracow, working on the Smolensk site; Amalgamated Industrial Construction Enterprises "East", on the Khmel'nickij site and Kablobeton of Warsaw, on the Kursk project. Polish Foreign Trade, Warsaw, Nos. 3 and 4, 1981, in ECPE, vol. 5, No. 8, August 1981, p. 17.

Romania.—The Romanian power program published at the end of 1979 was directed to self-sufficiency in the energy sector by 1990. Romania hopes to recover its pre-1979 independence in energy production for it is only since 1979 that it has become a net importer of oil. To meet this goal, Romania will count increasingly on nuclear energy which should, by the end of the 1980s, represent 17 to 18 percent of the total installed capacity; [109] and by the year 2000 40 to 50 percent.

Romania, the only full member country of the CMEA to have opted for western technology, is planning to build 16 units. The State Committee for Nuclear Power, Romenergo, signed an agreement in December 1978 with Atomic Energy of Canada Limited (AECL) [110] for the purchase of a 685 MWe reactor of the PHWR-CANDU type.[111] An order for a second unit was placed in July 1981. Both were sold on a turn-key basis. Situated near Cernavoda on the Danube, these units are scheduled to come on line between 1987 and 1990.

According to the contract, AECL and associated Canadian manufacturers are responsible for the nuclear steam supply system. An Italian-American consortium consisting of Ansaldo Impianti and General Electric (GE) won a 320 million dollar contract for the delivery of equipment for the balance of plant including turbine generator sets and auxiliary equipment.[112] They signed licensing agreements which will enable Romania gradually to take over the construction of the following 12 units. Presently, Ansaldo-GE are negotiating agreements for the third and fourth units of Cernavoda.[113]

The financing of the Ansaldo-GE orders will be assumed by the United States Export-Import Bank for the GE share and by a consortium of Italian banks for Ansaldo, guaranteed by the Italian government. The orders for the two reactors are estimated to be worth 750 million dollars to Canadian manufacturers; one billion dollars were made available by Canada's Export Development Corporation and consortium of Canadian chartered banks.[114]

By 1990, Romania expects to have six units of the PHWR type for a total capacity of 4110 MWe (see table 10).[115] The program is already falling behind schedule. The delays are both financial and technical. Romania is desperately short of hard currency and its plans to manufacture components for the nuclear plants are progressing slowly. Planning the commissioning of four reactors—2740

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[108] More specifically: 1.2 TWh of electricity in 1984, 2.4 TWh in 1985, 6 TWh annually during the 1988-2003 period. Ibid.

[109] Nuclear News, vol. 22, No. 11, p. 53.

[110] All major Romanian press, December 18-20, 1978.

[111] See appendix 1.

[112] GE's share in the order is $140 million for the turbines and Ansaldo Impianti will deliver for $180 million the balance of plant including the water and air equipment, the nitrogen plant and the control units.

[113] ECPE, vol. 5, No. 3, February 1981, pp. 17-18.

[114] Ibid.; ECPE, vol. 5, No. 8, August 1981, p. 16 cites the Canadian Press Agency, Ottawa, July 21, 1981.

[115] FER, Romanian SR No. 2, February 1981, pp. 12-13.

MWe—would be more realistic; it would represent 9 percent of the total generating capacity (see appendix 7).

Another questionable aspect of Romania's nuclear power plans is its long term commitment to western technology. The Tass Agency recently disclosed information concerning the construction of a Soviet nuclear power station in Romania during the current FYP.[116] There was no mention of this proposition in the Romanian press. Yet this information deserves consideration since Romania never excluded possible contractual relations with the Soviet Union in the nuclear field. The outcome depends on Romania's ability to take over from western companies and overcome its financial constraints.

Cuba.—Cuba is a full member of the CMEA since 1972 (Observer since 1965). Its power resources being very limited, the production of electric energy depends almost exclusively on its imports of Soviet oil. The development of nuclear power should enable Cuba to reduce its oil imports considerably. The decrease, however, will be largely balanced by imports of nuclear equipment.

According to the agreement made in April 1976, the Soviet Union will supply two VVER-440 reactors.[117] The station is situated near the town of Cienfuegos; construction work started in 1977. The first unit is expected to be completed by 1985 and the second by 1988. Forecasts for 1990 refer to an installed capacity of 1,320 MWe and 1,700–2,000 MWe in the long term.[118] It seems, however, that only two units will be installed by 1990 (see appendix 9 and table 10). Construction of a second power plant is planned to start near Holguin towards the end of the 1980's.[119]

These quite amibitous objectives highlight Cuba's desire to develop nuclear power very rapidly to fulfill the electric needs of the country.[120]

Yugoslavia.—For the initiation of its nuclear program Yugoslavia turned to the Westinghouse Corp. and an agreement was signed in November 1973. For the initiation of its nuclear program and an agreement was signed in November 1973.[121]

The first 664 MWe unit of the Krsko station near Zagreb started operating at full capacity Feburary 10, 1982,[122] more than two years behind schedule. Its seems that both the Yogoslavs and Westinghouse are responsible for the delays. The International Atomic Energy Agency (IAEA) in Vienna served as the intermediary between Yugoslavia and the Westinghouse Corporation for the agreement and all subsequent relations. This tri-lateral arrangement was among the causes for the delay.

Until recently, Yugoslavia had fixed a goal of 12,000 MWe of total nuclear capacity by by the year 2000.[123] It was considerably reduced in 1980 to the more realistic figure of 6,000 MWe which would represent 17 percent of the total production of the planned 230 TWh.[124]

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[116] Tass Daily News Service, March 31, 1981. Release on discussions held in Moscow concerning the future energy cooperation between the two countries.

[117] Czechoslovakia will also provide some equipment. The agreement was concluded in Havana June 8, 1980. Rude Provo, June 9, 1980 in ECPE, vol. 4, No. 7, July 1980, p. 22.

[118] Revue Générale Nucléaire, September–October 1979, p. 536; D. Lavrenčič (1977), p. 62.

[119] ECPE, vol. 4, No. 11, November 1980, p. 19.

[120] See also J.F. Perez-Lopez (1979).

[121] J. Wydler (1978), pp. 6–9.

[122] Westinghouse Electric Corporation, Pittsburgh.

[123] Revue Générale Nucléaire, No. 2 April-May, 1978, p. 129; R. Jovanic, "Need for Nuclear Power Plants", Privredni Pregled, March 19, 1980. p. 11, in JPRS No. 75624, May 2, 1980 pp. 25–26.

The inital site the second power plant was Vir Island but it was abandoned because of strong local opposition.[125] Finally the site of Prevlaka was chosen. Construction, supposed to start in 1982–1983, was postponed to an unspecified date; and no order has been issued for this site.[126] In addition, seven other nuclear power stations are planned for 1995–2000 about which there is only incomplete information (see appendix 8).[127]

Perhaps as a consequence of the problems encountered in the Westinghouse contract, Yugoslavia may be negotiating with the CMEA and more particularly with the Soviet Union for the acquisition of Soviet type nuclear reactors. Again no reliable information has been made available.

Yugoslavia is also trying to determine the location and extent of its uranium reserves. A mine at Zirovski Vrh is estimated to yield 120 tons of U_3O_8 (yellow cake), an amount sufficient to produce the fuel needed for Krsko.[128] These uranium deposits constitute an important asset for Yugoslavia's energy policy.

Multilateral cooperation in the CMEA

The international energy crisis and the increase in electric needs intensified the development of nuclear energy and specialization/cooperation became an imperative necessity for the member countries of the CMEA. All the plans and programs since the XXIXth Session of the CMEA in 1975 attest to this concern. The cooperation efforts advanced to the stage of specialization with the signing of an actual specialization agreement of 1979.

Increased Specialization.—The priority for nuclear power programs was confirmed the following year by the XXXIIIrd Session of the CMEA with the signing of the agreement on "International Specialization, Coproduction, and Mutual Reciprocal Deliveries of Equipment for Nuclear Power Plants for the Period of 1981–1990", by the member countries as well as Yugoslavia. The agreement will be implemented under the auspices of Interatomenergo. Consistent with the concept of international socialist division of labor, some fifty national industrial associations and enterprises are involved in this cooperative effort. Each country is allocated a certain range of production and volume of deliveries. Czechoslovakia, as previously described, is the second supplier of nuclear equipment of the CMEA; it will provide 440 MWe reactors, steam generators, pumps and valves. Bulgaria will produce the necessary equipment for transportation and voltage regulators. Poland, which had already started producing steam generators, will specialize in the production of valves and fittings (as does Czechoslovakia). Hungary will continue delivering materials for the treatment of water from the primary and secondary systems, pumps, automatic devices, and the necessary equipment for the loading of the fuel. Lastly, Yugoslavia will deliver equipment such as feed-water pumps and transport apparatus. The Soviet Union maintains a dominant position, for it is the only country capable of producing heavy equipment and large reactors. Czechoslovakia had in fact planned to manufacture large units beginning in 1985 but, as was previously pointed out, this target is overly optimistic.

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[124] Ibid. p. 26.

[125] Announced officially by the Tarijug Agency, June 27, 1979.

[126] ECPE, vol. 3, No. 21, December 1979, p. 23; Nuclear News, vol. 22, No. 10, August 1979, p. 50.

[127] Politika, May 17, 1981.

[128] M. Petrovic (1981), p. 18 .

Joint projects.—While each country specializes in the manufacture of parts of the equipment, capital, assembly of the parts and personnel for construction will be furnished by each country in some appropriate proportion. At the 89th Session of the Executive Committee of the CMEA in March 1979, a cooperation agreement between Czechoslovakia, Hungary, Poland, and the USSR was concluded for the three projects discussed at the plenary session in 1978; the Khmel'nickij nuclear power plant (4,000 MWe), the high voltage power line (750 kV) from Khmel'nickij to the city of Rzeszow in Poland, and the construction of a sub-station.

The Khmel'nickij project is the most formidable venture to date, because the coordination of each country's responsibilities is new, complex and diverse. The cost of the nuclear power plant was estimated in 1979 at 1.5 billion transferable rubles (approximately 2.1 billion dollars). The USSR will contribute 50 percent of the cost. Czechoslovakia will contribute 235 million rubles in equipment and machine tools; Poland 400 million in goods and services; Hungary 115 million. In return, each country will receive over a 20 year period beginning when the first unit comes on line, a share of electricity proportional to its contribution. The three other units should be commissioned before 1987.[129]

The project to connect Khmel'nickij to Rzeszow and the general broadening of the interconnected grid is one of the largest common ventures of the CMEA and the future of the nuclear cooperation program relies heavily on the success of this project. Talks are also under way for the joint construction of the Južno-Ukrainskaja nuclear power station in the USSR.

Unifying the interconnected grid (Mir) of the six European countries of the CMEA is a Central Dispatching Office responsible for the management of the grid. It has been operating in Prague since 1962. At the end of 1978, the Soviet grid was connected to the East European one by a 750 kV power line. It goes from the Cernobyl'skaja station in the Ukraine, passes the sub-station Vinnica and ends in Albertirsa, Hungary, near Budapest. The Khmel'nickij station was also to be connected to Vinnica at the end of 1980; but no information about this has been released.[130]

CONCLUSION

The Soviet nuclear program and Soviet cooperation with Eastern Europe in this area can best be interpreted with relation to the larger goals of the Soviet Union and the ways in which it pursues them.

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[129] Thus Czechoslovakia will receive 900 million KWh in 1984, 1.8 TWh in 1985, 2.4 TWh in 1986, 3.0 TWh in 1987 and 3.6 TWh yearly from 1988 to 2003. Rude Pravo, May 29, 1979.

[130] Energetičeskoie Stroitelstvo, No. 12, 1978; Rabotničesko Delo, January 12, 1979 in ECPE, vol. 3, No. 3, January 1979, p. 10.

Part of the Soviet Union's motivation for the development of a nuclear program is its economic appeal. Nuclear power is believed to be one of the most important renewable energy resources for the future and therefore it is in the interest of the Soviet Union to master this technology and encourage its development in Eastern Europe to stimulate the economic growth of the entire region. In addition, by developing nuclear power in Eastern Europe, the Soviet Union offered an alternative to their obtaining fuel from countries outside the CMEA thereby eliminating a threat to CMEA cohesion and Soviet leverage. Finally, there were benefits to be gained by enlisting Eastern Europe's production potential in the build up of a consistent program.

The Soviet Union also faced the political and strategic problem of not letting Eastern Europe acquire too much independence. This aspect—a constant concern of the Soviet Union regarding its relations with Eastern Europe—is accentuated with nuclear power because of the risk of proliferation.

Although the civilian and military dimensions of the nuclear industry were carefully separated throughout this study, it is in their inseparable relationship that some clues may be found for the understanding of Soviet behavior. The Soviet Union was always concerned about proliferation. When it modified its prohibitive policy in the nuclear field in 1955 and offered technical assistance for "peaceful uses of atomic energy", either it did not realize how easily the material could be converted for weaponry, or was willing to accept the risk for the benefits it might gain. However, as soon as events developed in an unacceptable manner, the Soviet Union put an end to the transfer of nuclear technology. From 1958 to 1965, there was little or no development. The program moved ahead only when the Soviet Union had restored its control and created the conditions it deemed favorable for it. When the Soviet Union launched in 1970 a large scale program, it simultaneously instituted an appropriate system of control through CMEA integration.

The CMEA has become a single geo-political and economic strategic entity which serves to strengthen the Soviet Union. The programs for cooperation and specialization have brought about a network of mutual interdependence which simultaneously binds the East European countries to the Soviet Union and forecloses the possibility of independence for any or all of them from the Soviet Union. While this alters the previously total dependence of the CMEA countries on the Soviet Union and makes it possible for them to assert their claims to participate in decisions, the loss of a certain amount of control by the Soviet Union is compensated by the benefits derived.

Control by the Soviet Union was never abandoned; it merely took on more subtle and sophisticated forms. As said before, the structure of agencies, committees, commissions and the like required for the administration of the nuclear program limits authority and by assigning it to a Soviet dominated agency, that has final control of all aspects of the nuclear power program.

Given the persisting gap between planned and achieved goals, targets for the 1990's will most likely not be obtained. Nevertheless, there are some circumstances that may contribute to narrow-

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ing the gap, Atommaš is expected to start assembly line production of VVER-1000 MWe reactors; expertise with construction of stations and the operation of equipment has been acquired in preceding periods. From this point of view, the Soviet Union may be successful in its long term strategy.

However, if the fast breedeer reactor is to be pursued jointly with Eastern Europe—as has been repeatedly asserted—and such reactors are to be erected in the CMEA countries, the relationship between the Soviet Union and Eastern Europe will most likely have to be adapted to deal with the accumlation of plutonium in Eastern Europe.

APPENDIX 1.—TYPES OF REACTORS DEVELOPED IN THE CMEA COUNTRIES

BWR.—Boiling Water Reactor, lightly enriched uranium.

FBR.—Fast Breeder Reactor, sodium cooled, Enriched uranium and/or plutonium.

GLWR.—Graphite Moderated and Light Water Cooled Reactor, natural or lightly enriched uranium.

HTGR.—High Temperature Gas cooled, Graphite moderated Reactor, highly enriched uranium and thorium.

HWGCR.—Heavy Water moderated and Gas Cooled Reactor, natural or lightly enriched uranium.

PHWR.—Pressurized Heavy Water moderated and cooled Reactor, natural or lightly enriched uranium.

(CANDU).—Canadian Deuterium Uranium.

PWR.—Pressurized Light Water Reactor, lightly enriched uranium.

RBMK.—Reaktor Bol'šoj Moščnosti Kipjaščij (Large capacity boiling water reactor) Graphite moderated and water cooled, Natural or lightly enriched uranium.

VVER.—Vode Vojanie Energetičeskie Reaktor (Water-water reactor) Soviet name for PWR.

APPENDIX 2.—THE NUCLEAR POWER PROGRAM IN BULGARIA—AS OF JANUARY 1, 1982

Name of station		Location	River	Reactor capacity NWE gross/net	Reactor type	Order	Initial operation forecast	Construction start	Criticality	Coupling to grid	Commerical operation
Kozloduj	1–1	Kozloduj-Harletz.	Danube	440/405	VVER	1966	1970	October 1969	June 30, 1974	July 1974	September 4, 1974
Do	1–2	do	do	440/405	do	1966	1970	April 1970	August 22, 1975	September 1975	December 1975
Do	1–3	do	do	440/405	do	1972	1979	October 1973	December 4, 1980.	December 17, 1980.	December 17, 1980
Do	1–4	do	do	440/405	do		1979	1974			1982
Do	2–1	do	do	1000/953	do	1979	1985	July 1980			1986
Do	2–2	do	do	1000/953	do	1979	1986				1990
Do	2–3	do	do	1000/953	do	1979	1990				1990
Do	2–4	do	do	1000/953	do	1981	1995				1995
Do	1	Belene	do	1000/953	do	1981	1992				1992
Do	2	do	do	1000/953	do	1981	1995				1995
Do	3	do	do	1000/953	do	1981					
Do	4	do	do	1000/953	do	1981					

Sources: CEA/DPG-GIDE/82–299/J. C. Le Ralle "Heti Vilaggazdasag," Budapest, May 9, 1981.

APPENDIX 3.—THE NUCLEAR POWER PROGRAM IN CZECHOSLOVAKIA—AS OF JANUARY 1, 1982

Name of station		Location	River	Reactor capacity MWe gross/net	Reactor type	Order	Initial operation forecast	Construction start	Criticality	Coupling to grid	Commercial operation
A–1		Jaslovske Bohunice.	Vah	143/104	HWGCR	1956		1958	Oct. 24, 1972	Dec. 1972	Dec. 1972.[1]
Bohunice	VI–1	Trnava	Blava	413/381	VVER	1970		1973	Nov. 28, 1978	Dec. 20, 1978	Dec. 1978.
Do	VI–2	do	do	413/381	VVER	1970		1974	Mar. 15, 1980	Mar. 27, 1980	May 1980.
Do	V2–1	do	do	440/420	VVER	1973	1980	1975			1983.
Do	V2–2	do	do	440/420	VVER	1973	1981	1976			1984.
Dukovany	V3–1	Trebic	Jihlava	440–420	VVER	1971	1979	March 1974			1984.
Do	V3–2	do	do	440/420	VVER	1974	1980	1975			1984.
Do	V4–1	do	do	440/420	VVER	1977	1984	1978			1985.
Do	V4–2	do	do	440/420	VVER	1977	1985	1979			1985.

Mochovce	1	Levice	Hron	440/420	WER	1979	1985	1979	1987.
Do	2	do	do	440/420	WER	1979	1986		1988.
Do	3	do	do	440/420	WER	1979	1988		1988.
Do	4	do	do	440/420	WER	1979	1989		1989.
Malovice	1	Budojevice	do	1000/953	WER	1980	1987		1988.
Do	2	do	do	1000/953	WER	1980	1988		1990.
Do	3	do	do	1000/953	WER	1980	1989		1992.
Do	4	do	do	1000/953	WER	1981	1993		1993.
Blahutovia	1	do	do	1000/953	WER	1981	1990		1990.
Do	2	do	do	1000/953	WER	1981	1991		1992.

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[1] The A-1 station was shut down in 1977.

Sources: CEA/DPG-GIDE/82-299/J. C. Le Ralle "Skoda Review," Prague, No. 3, 1981.

APPENDIX 4.—THE NUCLEAR POWER PROGRAM IN THE G.D.R. AS OF JAN. 1, 1982

Name of station, location and river	Reactor capacity MWe gross/net	Reactor type	Order	Initial operation forecast	Construction start	Criticality	Coupling to grid	Commercial operation
AKW—1, Rheinsberg, cooling tower	80/70	WER	1956		1960	Mar. 11, 1966	May 1966	May 9, 1966.
Nord 1—1, Lubmin, Baltic Sea	440/408	WER	1965		1969	Dec. 3, 1973	Dec. 1973	1974.
Nord 1—2, Lubmin, Baltic Sea	440/408	WER	1965		1970	Dec. 1974	Dec. 1974	1975.
Nord 1—3, Lubmin, Baltic Sea	440/408	WER	1973		1973	Oct. 1977	Nov. 1977	1978.
Nord 1—4, Lubmin, Baltic Sea	440/408	WER	1973		1974	Sept. 1979	Oct. 1979	1979.
Magdeburg—1[1], Magdeburg, Elbe	440/408	WER		1979	1974			1982.
Magdeburg—2, Magdeburg, Elbe	440/408	WER	(3)	1980	1974			1983.
Magdeburg—3, Magdeburg, Elbe	440/408	WER	(3)	1980	1976			1983.
Magdeburg—4, Magdeburg, Elbe	440/408	WER	(3)	1980	1976			1984.
Nord 2—1, Lubmin, Baltic Sea	440/420	WER		1984	1979			1984.
Nord 2—2, Lubmin, Baltic Sea	440/420	WER		1984	1979			1985.
Magdeburg—5, Magdeburg, Elbe	[2]440/420	WER	[4]1974	1981	1980			1985.
Magdeburg—6, Magdeburg, Elbe	[2]440/420	WER	[4]1974	1981				1986.
Magdeburg—7, Magdeburg, Elbe	[2]440/420	WER	[4]1974	1982				1987.
Magdeburg—8, Magdeburg, Elbe	[2]440/420	WER	[4]1974	1982				1988.
Nord 2—3, Lubmin, Baltic Sea	440/420	WER	1979	1987	1981			1987.
Nord 2—4, Lubmin, Baltic Sea	440/420	WER	1979	1988	1981			1988.

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[1] Also known as the Stendal station.

[2] There is talk of these units being 1000 MWe instead of 440 MWe [illegible]PE, Vol. 5, No. 5, page 19.

[3] Original order unknown; reordered in 1980.

[4] Reordered in 1980.

Sources: CEA/DPG-GIDE/82-299/J. C. Le Ralle.

APPENDIX 5.—THE NUCLEAR POWER PROGRAM IN HUNGARY AS OF JANUARY 1, 1982

Name of station	Location	River	Reactor capacity MWe gross/net	Reactor type	Order	Initial operation forecast	Construction start	Criticality	Coupling to grid	Commercial operation
Paks—1 (Donau)	Paks	Danube	440/397	VVER	1966	1975	1973	Imminent		1982.
Paks—2 (Donau)	do	do	440/397	do	1966	1976	1975			1983.
Paks—3 (Donau)	do	do	440/408	do		1983	1977			1984.
Paks—4(Donau)	do	do	440/408	do		1984	1979			1985.
Paks—5 (Donau)	do	do	1000/953	do	1979	1989				1989.
Paks—6 (Donau)	do	do	1000/953	do	1981	1991				1991.
Paks—7 (Donau)	do	do	1000/953	do	1980	1992				
Paks—8 (Donau)	do	do	1000/953	do	1980	1995				

Sources: CEA/DPG-GIDE/82-299/J. C. LeRalle.

APPENDIX 6.—THE NUCLEAR POWER PROGRAM IN POLAND AS OF JANUARY 1, 1982

Name of station	Location	River	Reactor capacity MWe gross/net	Reactor type	Order	Initial operation forecast	Construction start	Criticality	Coupling to grid	Commercial operation
Zarnowiec-1	Zarnowiec	Zarnowiec Lake.	440/408	VVER	1974	1985	1981			1988.
Zarnowiec-2	do	do	440/408	do	1976	1987				1989.
Zarnowiec-3	do	do	440/408	do		1990				1991.
Zarnowiec-4	do	do	440/408	do						
Kujawy-1	Ciecochinek	do	1000/953	do	1978	1991				1991.
Kujawy-2	do	do	1000/953	do						
Kujawy-3	do	do	1000/953	do						
Kujawy-4	do	do	1000/953	do						

Sources: CEA/DPG-GIDE/82-299/J. C. Le Ralle "Trybuna Ludu," Warsaw, Jan. 22, 1981.

APPENDIX 7.—THE NUCLEAR POWER PROGRAM IN ROMANIA AS OF JANUARY 1, 1982

Name of station	Location	River	Reactor capacity MWe gross/net	Reactor type	Order	Initial operation forecast	Construction start	Criticality	Coupling to grid	Commercial operation
Olt [1]	Pitesti	Olt	440/410	VVER	1970	1980	1975 [1]			Canceled.
Cernavoda-1	Cernavoda	Danube	685/640	PHWR	1978	1987	1980			1987.
Cernavoda-2	do	do	685/640	do	1981	1989				1989.
Cernavoda-3	do	do	685/640	do		1990				1990.
Cernavoda-4	do	do	685/640	do		1990				1990.

[1] Canadian sources indicate that construction work has not started as yet; the station has most likely been canceled.

Sources: CEA/DPG-GIDE/82-299/J. C. Le Ralle.

APPENDIX 8.—THE NUCLEAR POWER PROGRAM IN YUGOSLAVIA AS OF MAY 1, 1982

Name of station, location, and river	Reactor capacity MWe gross/net	Reactor type	Order	Initial operation forecast	Remarks
Krsko—1, Krsko, Sava.	664/632	PWR	1973	1979	Construction start, Dec. 1, 1974; criticality, Sept. 11, 1981; coupling to grid, Oct. 2, 1981; commercial operation, April 1982.
Prevlaka:					
Ivanicgrad, Sava	664/632				38 km downstream from Zagreb joint venture of Croatia and Slovenia utilities.
Dolsko (Slovenia), Sava.					70 kms upstream from Krsko, Slovenia.
Zadar:					
Vir Island, Adriatic Sea.					Opposition in 1979 led to the choice of Prevlaka instead.
Smeredevo or Kostolac.				1975	Total capacity of the plant: 1,000 MW—Serbia.
1 Bukovar	1,000/953			1993	Joint Serbian and Croatian project.
2	1,000/953				
1 Batina-Apatin, Dunar.	1,000/953			1995	Vojvodina.
2	1,000/953				
Macedonia, Vardar					Macedonia.

Sources: Westinghouse Electric Corp., Pittsburgh. Politika, Belgrade, May 17, 1981.

APPENDIX 9.—THE NUCLEAR POWER PROGRAM IN CUBA AND FINLAND AS OF JANUARY 1, 1982

Name of station, location and sea	Reactor capacity MWe gross/net	Reactor type	Order	Initial operation forecast	Construction start	Criticality	Coupling to grid	Commercial operation
Cuba:								
Cienfuegos—1, Cienfuegos, Caribbean Sea	440/410	VVER	1975	1984	1977			1985.
Cienfuegos—2, Cienfuegos, Caribbean Sea	440/410	VVER	1978	1986				1988.
Cienfuegos—3, Cienfuegos, Caribbean Sea	440/410	VVER		1990				1990.
Holguin—1, Holguin	440/410	VVER						
Finlande:								
Loviisa—1, Loviisa, Finland Golf	465/442	VVER	1970	1977	1971	Feb. 20, 1977	Feb. 1977	1977.
Olkiluoto—1 [1]	691/660	[2]BWR	1972		1973	July 21, 1978	Sept. 1978	1978.
Olkiluoto—2 [1]	691/660	BWR	1974		1975	Oct. 13, 1979	Feb. 1980	1980.
Loviisa—2, Loviisa, Finland Golf	440/420	VVER	1971	1980	1972	Oct. 17, 1980	Nov. 1980	May 1981.
Loviisa—3, Loviisa, Finland Golf	1,000/953	VVER	1974	1981				

[1] Built by the Finnish Teollisnuden Voima Oy Enterprise in cooperation with the Swedish ACEA-Atom Firm, Atomnaja Energija, vol. 44, No. 2., February 1978, p. 173–174.
[2] See appendix 1.

Source: CEA/DPG-GIDE/82-299/J.C. Le Ralle.

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V. SCIENCE AND TECHNOLOGY

OVERVIEW*

By Donna L. Gold**

Throughout the post-Stalin period, the Soviets have emphasized the importance of science and technology to their economic development. Unlike their initial economic growth strategy of extensive development which called for increases in the quantity of factors of production, their current economic growth strategy, intensive development, stresses increases in the efficiency of these factors. This productive efficiency is to be achieved in the main through scientific and technological progress. This process, as described by the Soviets, is governed by the ongoing Scientific and Technical Revolution (STR). According to the STR, the role of science and technology becomes more significant in an advanced society. "Science leads production. The basic technological imperative is to incorporate scientific achievements into practice." [1]

The technologically superior West has served as a stimulant and a source for such change. Soviet efforts to catch up and eventually forge ahead of the West have included: modifications within their own science system, the adoption of the new inventions and technologies produced within the Council for Economic Mutual Assistance (CEMA),[1a] the communist economic alliance, and the importation and utilization of significant amounts of foreign technology. These efforts, however, have been impeded by certain features of the Soviet economy. A rigid planning system controlled by a highly centralized bureaucracy limits the pace at which scientific and technological innovations can be developed and introduced.[2] A lack of incentives and competition discourages industrial managers from adopting new inventions and technologies. They tend to resist any changes that pose a risk to the production quotas included in the plan. Civilian technology in the U.S.S.R. in general has remained inferior to that of the West.

Internally, the Soviets have increased the attention being paid to applied science. While basic science has traditionally been an area of strength, this area of scientific research has been comparably weak. Changes in Soviet scientific management,[3] including the establishment of a rather complete and complex patent system,[4] have been fashioned to help remedy deficiencies in applied science. The inventors' certificate, first introduced in 1931, continues to be the socialist counterpart to the capitalist patent, the main difference being that this document guarantees that "the rights to use the invention belong to the state" and not the individual. The Committee for Inventions and Discoveries currently responsible for the administration of these certificates has acted as an independent governmental body since 1955 and has been a State Committee since 1973. As the official Soviet patent office, the State Committee for Inventions and Discoveries: promotes the use of new inventions within individual enterprises and recommends that they be used in ministerial plans; promotes the economic importance of inventing while raising "patent consciousness" among industrial officials; handles foreign patent literature, including its distribution throughout the U.S.S.R.; trains people in the various aspects of patenting; provides a centralized system for granting bonuses to those inventors whose inventions are used; checks that Soviet inventions do not violate foreign patents; and recommends to other agencies which inventions should or should not be patented abroad.

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*This overview is drawn from the contents of the papers in section five of this volume. The findings and analyses are primarily those of the authors of these papers. Selected information has been added to provide context and continuity to the discussion.

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[1] Robbin Laird, "Post-Industrial Society East and West," Survey, Vol. 21 no. 97 Autumn 1975 pp. 8–10.

[1a] CEMA is commonly referred to as CMEA, the Council for Mutual Economic Assistance. It is also known as COMECON.

[2] For an analysis of Soviet attempts to improve the technological performance of their economy see "Soviet Policy Towards Technological Changes Since 1975" by Martin C. Spechler in section one of this volume.

The establishment of a socialist patent system has been important to Soviet technological development in three principal ways. First, the availability of Soviet patents to foreigners has encourages the sale of technology to the U.S.S.R.; second, access to foreign patent information has provided the Soviets with a means of comparison for their exports; and third, foreign patent data has enabled the Soviets to monitor Western industrial trends. This information helps the Soviets in their planning of research and development and assists them in technological forecasting.

Soviet ideology, providing for a centrally planned economy, has made the State a central participant in the invention process. "Soviet economic officials believe that only by such a degree of state involvement can technological developments become efficiently used." Also, the State is likely to be concerned about individual enterprises directly controlling and pricing new technology because such rights are considered an unacceptable delegation of economic power to the local level.

The State poses certain additional problems for the incorporation of new CEMA technology [5] into the Soviet economy. Each CEMA member places its national economic needs before that of the CEMA and no CEMA member is under any obligation to promote the results of cooperative scientific research and development and technological innovation (RDI). The absence of a uniform system for calculating the effects of CEMA projects and the lack of national incentives to join in these projects are further barriers to full and complete RDI integration within CEMA.

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[3] Soviet science policy is coordinated by the State Committee for Science and Technology, the State Planning Committee (Gosplan) and the U.S.S.R. Academy of Sciences. For a comprehensive discussion of the organizational structure of Soviet Science see "Soviet Science Policy Formulation" by John Turkevich in *Soviet Science and Technology: Domestic and Foreign Perspectives*. Edited by John R. Thomas and Ursula M. Kruse-Vaucienne (Washington, D.C.: The George Washington University), 1977, pp. 15–43.

[4] The following discussion of Soviet patents is based on the paper "Soviet Patents and Inventors' Certificates," by John A. Martens included in this section.

[5] The following discussion of CEMA science and technology is based on the paper "Integration of CEMA Science and Technology," by Louvan E. Nolting included in this section.

Despite these drawbacks, CEMA scientific and technical integration has made significant progress, especially over the last decade. In sum, CEMA RDI has been transformed from "rudimentary contacts and incidental exchanges in science and technology to a set of elaborate multilateral and bilateral RDI plans." Under the direction of the Complex Program to Intensify and Improve Cooperation and Development of the Socialist Economic Integration of the CEMA Member Countries, approved in July 1971, the groundwork was set for 15 to 20 years of cooperative work on comprehensive programs. Other measures were adopted in the mid-1970s that further underscored this commitment to joint projects and cooperative RDI plans on the multilateral level. By 1980, more than 3,000 scientific and engineering institutes and organizations in the CEMA countries were working on approximately 4,000 collaborative RDI projects.

The Communist bloc as a whole as well as individual countries have benefited from this further integration of CEMA science and technology. "It has sped up scientific discoveries, increased the number of new products and production techniques and promoted national specialization in RDI and indirectly in industry." The Soviet Union in particular has greatly benefited in the area of computers. More generally, Soviet technological potential has increased overall by about 25 percent.

Directly and through its involvement in CEMA the Soviet Union has also acquired access to the technology of Western countries. Whether such technology is "dually used," i.e., used for both civilian and military purposes, is under much debate in the West.[6] Concern has been expressed over the possibility of CEMA members transferring militarily useful technology from the West to the U.S.S.R.

The Soviets have turned to the West for technology in conjunction with their stress on productivity growth.[7] This was especially evident during the 1960s and 1970s. Soviet trade with the West climbed to over 30 percent of their total trade turnover in the mid 1970s. Of course, some of this increase in trade was due to grain imports, but technology imports rose as well. Specific industries—chemical, automotive, oil and gas—which had been given priority by the Soviet leadership, became the primary beneficiaries of this infusion of Western technologies. Other parts of the Soviet economy, including the agricultural sector and the electrical, steel, food processing, and building materials industries, however, remained low in "import dependence". Although the volume of machinery sales to the Soviet Union is the usual basis for calculating how much Western technology is transferred to the Soviet Union, the purchases of licenses, technical data, books and periodicals, participation in scientific and technological exchange programs, attendance at foreign conferences and seminars, study at foreign universities and industrial espionage are also conduits for transmitting Western technology to the Soviet Union.

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[6] See "Soviet Acquisition of Western Technology" U.S. Central Intelligence Agency in *East-West Trade and Technology Transfer.* Hearing before the Subcommittee on International Finance and Monetary Policy of the Senate Committee on Banking, Housing and Urban Affairs. April 14, 1982, 97th Congress, Second Session. U.S. Government Printing Office, Washington, D.C. 1982 pp. 23–37.

[7] The following discussion of direct Western technology transfer to the Soviet Union is based on the paper "Western Technology Transfer to the Soviet Union: Problems of Assimilation and Impact on Soviet Exports" by George D. Holliday included in this section.

Part of the Soviet strategy of increasing its imports from the West has been the effort to build up its modern export capability to earn hard currency. The growth in imports of technology over the last two decades has resulted in a hard currency debt of $14 billion as of 1981 for the Soviet Union. Traditionally the Soviets have been exporters of raw materials, particularly oil, gold, and timber. However, sharp increases in the costs of obtaining these materials have forced the Soviets to look to other product markets. Western technology has been relied on to produce many of these new exportable goods.

A decline in Soviet legally-purchased imports of Western technology in the late 70s into the early 80s (if one excludes the imports associated with the construction of the Siberian-West European pipeline) and evidence of an ongoing debate among Soviet officials have given some Western observers reason to believe that the Soviets are reevaluating their dependence on high levels of imported technology. To date, such imports have had mixed success in the Soviet Union. The assimilative capacity of Soviet industries, meaning their ability "to import, put into operation and diffuse foreign technologies to other parts of the economy," remains poor. The lead times for starting up operations using foreign technologies are long and once started these operations run less efficiently than their Western counterparts. The ability to distribute and absorb imported technology among various sectors of the Soviet economy is also limited. Meanwhile, Soviet exports of manufactured goods, which in many cases are now produced from Western technology, have not brought in the expected hard currency earnings. A lack of marketing experience, a reputation for poor maintenance and poor after-sales services, the production of goods ill-suited for Western needs and a lack of knowledge in production techniques have made these products non-competitive on the world market. "In 1979, exports to the West of finished manufactured goods earned $761 million, accounting for only 4 percent of total hard currency earnings from merchandise exports". Automobile exports led this group. Though certain chemical exports, e.g., ammonia and urea, also produced from Western technology, have increased, they still earn only a limited amount of hard currency. A recession in the West is also likely to have contributed to disappointing Soviet hard currency earnings.

Although these problems are seen as having contributed to the recent decline, most Western observers feel that the drop in Soviet imports of Western technology does not signify a change in the Soviet attitude towards Western technology. Western assessments indicate that the Soviets have gained substantially from imports of Western technology and as a result seem unlikely to forgo these benefits in the future. The assimilation problem appears to be only a temporary impediment to the growth of Soviet imports of Western technology. The Soviets are likely to continue to import Western technology despite assimilative difficulties. The poor performance of Soviet exports may be a more lasting constraint. Most Western observers predict that Soviet exports will be unable to earn the hard currency needed to pay for grain and additional technology. Therefore, the Soviets will probably be forced to depend upon exports of their natural resources and semi-processed goods in order to continue importing technology.

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The Soviet Union appears likely to remain an industrial giant with a comparably weak civilian technological capability throughout the 1980's. Although advancement in science and technology are integral to Soviet economic growth, the gap between science and research application to production remains wide and the assimilation of foreign technology into the Soviet system remains slow and limited. The necessary scientific and technological strides needed to facilitate continuous economic growth have not been made. Progress in this direction has been slow and incremental. Constraints, perhaps inherent in the Soviet system, have prevented the attainment of full scientific and technological potentials. A good deal of the Soviet scientific research and development continues to be conducted independent of the needs of industrial production; many inventions never reach the factory. Institutional barriers hinder necessary scientific interaction; no "invisible college" of scientists performs the function of disseminating research results. Soviet scientists in large part are financially secure and have little material incentive to focus on specific industrial needs. Moreover, industrial plant managers lack the incentive to incorporate new technology into their production schemes. The threat of failing to meet their production plan is too great for many to undertake the short-run risks associated with switching to new systems.

With the Soviet economy expected to experience major problems during the next few decades, e.g., labor and material shortages, the need for applied technology change will increase. As domestic research may continue to fall short of their needs, foreign technology may become even more critical.[8] The Soviets will especially need assistance in developing their vast Siberian resources, which appear to be key to future hard currency earnings. In addition, the importation of foreign technology will continue to free up the Soviet research resources that would otherwise be used for the research obtained from the West, to potentially speed up Soviet research processes, and to assist in the more rapid and efficient development of the infrastructure of the U.S.S.R.

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[8] The possibility of a return to an autarkic economic policy with the West in the post-Brezhnev succession period cannot be overlooked. The occurrence of such a policy shift, however, appears highly unlikely in the area of science and technology. An autarkic policy in this area would involve substantial losses in terms of future Soviet scientific and technological development.

WESTERN TECHNOLOGY TRANSFER TO THE SOVIET UNION: PROBLEMS OF ASSIMILATION AND IMPACT ON SOVIET EXPORTS

By George D. Holliday*

CONTENTS

	Page
Summary	514
Introduction	514
Trends in Soviet Imports of Technology	517
A Reappraisal of Technology Import Policy	520
Problems in Assimilating Western Technology	521
Export Competitiveness on Western Markets	524
Conclusions and Outlook	528

SUMMARY

The purpose of this paper is to examine Soviet experience during the 1960s and 1970s in assimilating Western technology and using imported technology to generate new exports to the West. It analyzes trends in Soviet imports of Western machinery and equipment and related exports. In addition, it analyzes case studies, surveys and other materials describing the Soviet assimilation process and the degree of Soviet success in exporting to Western markets. The paper addresses the question of whether and to what extent Soviet dissatisfaction with recent experience has resulted in a retrenchment of Soviet technology import plans.

INTRODUCTION

Since the early 1960s, Soviet economic planners have placed growing emphasis on importing technology from the West. However one measures technology flows—the value of imports of machinery and equipment, numbers of industrial cooperation agreements, licensing activity, or, most importantly, movement of technically competent people across its borders—it is clear that the Soviet leadership has placed a significantly higher priority on technological interaction with the industrial West. The emphasis on technology imports is an integral part of a new Soviet economic growth strategy which has emerged during this period.

The intense interest of Soviet economic planners in Western technology has a historical parallel in the Soviet era. During the Soviet First Five-Year Plan (1928–1932), there was a similar upsurge in technology imports. Soviet imports of Western machinery and equipment grew rapidly during that period: according to official Soviet data, the value of such imports averaged four times that of the previous five years.[1] Soviet industry officials signed numerous technical assistance agreements with foreign firms, and Western businessmen, engineers, and technicians traveled to Soviet construction sites in significant numbers.[2]

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Unlike the current period, however, the earlier period of intense interest on Western technology was short-lived. After peaking in 1931, machinery and equipment imports declined rapidly to the level that prevailed before the First Five-Year Plan. Soviet officials abruptly terminated technical assistance agreements and rapidly reduced the number of people traveling to and from the Soviet Union. From the end of the First Five-Year Plan to the early 1960s, the Soviet Union went through an extended period in which trade with the West was assigned a distinctly lower priority in Soviet economic plans.

There is substantial agreement among Western scholars on the major reason for renewed Soviet interest in Western technology during the 1960s and 1970s. For a number of years, a major theme in Soviet economic literature and a central tenet in Soviet economic plans has been the need to shift from an extensive to an intensive growth strategy. By this, Soviet economists mean that future growth must rely increasingly on productivity gains instead of the traditional reliance on rapidly increasing inputs of land, labor and capital.

The primary reason for instituting what has been termed a "new growth model" [3] is evident: The Soviet economy is experiencing a significant slowdown in the growth of inputs of labor and capital. Shorter work hours and a slowdown in the growth of the work force are creating a substantial labor shortage in the Soviet Union, a trend that is likely to be exacerbated in the late 1980s and 1990s. At the same time, Soviet planners are finding it difficult to maintain the high rates of capital investment that have characterized the extensive growth pattern. The number of claimants on Soviet capital investments has grown. The needs of agriculture, defense and consumers are diverting resources away from the growth-promoting sectors of the economy. Thus, improving the efficiency of the economy and increasing productivity are seen as the major sources of future growth for the Soviet economy. More rapid technological progress, including increases in technology imports, is considered a key to faster productivity growth.

During the 1960s and 1970s, the renewed interest in Western technology led Soviet planners to allocate a significantly larger amount of resources to imports. During that period, foreign trade was one of the most dynamic sectors of the Soviet economy, growing much faster than the economy as a whole. Moreover, trade with Western industrial countries began to account for an increasingly large share of total Soviet trade. From an average of less than 20 percent in the early 1960s, trade with the West rose to over 30 percent of total trade turnover by the mid-1970s. While some of the increased trade with the West was due to large grain imports, imports of high-technology items also increased rapidly.

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[1] U.S.S.R. Ministerstvo vneshnei torgovli. Glavnoe tamozhennoe upravlenie. Vneshniaia torgovlia SSSR za 1918–1940 gg. Statisticheskii obzor. Moscow: Vneshtorgizdat, 1960.

[2] Holliday, George D. Technology Transfer to the USSR, 1928–1937 and 1966–1975: The Role of Western Technology in Soviet Economic Development. Boulder, Colorado; Westview Press, 1979. p. 43–49.

[3] Bergson, Abram. Soviet Economic Perspectives: Toward A New Growth Model. Problems of Communism, March–April, 1973.

An integral part of the new Soviet foreign trade strategy, is a greater emphasis on building modern export industries. There has been a concerted drive to produce high-quality manufactured goods which can be marketed in the West. To some extent, the export drive is a necessary corollary to increased imports of technology. For much of the 1960s and 1970s, Soviet hard currency earnings were insufficient to pay for the desired level of imports of technology and grain. As a consequence, the Soviet Union has relied heavily on trade credits, accumulating an estimated hard currency debt of $14 billion by 1981. While Western export credits have assisted, and to some extent will probably continue to assist, Soviet importers of Western technology, such credits must eventually be repaid with Soviet exports to the West.

It is important to keep the new Soviet orientation to imports of Western technology and Western export markets in perspective. While there has been a notable shift in Soviet trade policy in the past two decades, the Soviet Union is still not a major participant in (Western) international technology trade. Compared with the major Western trading countries, it is neither a major importer of technology nor a major exporter of high-technology manufactured goods. One measure of the relatively small role of the Soviet Union as an importer of Western technology is provided by a U.S. Department of Commerce study by John A. Martens.[4] The study calculates that total Western exports of "high-technology" products to all countries in 1970 totaled $24,770.9 million. Of this, the Soviet Union imported $402.9 million, or less than 2 percent of the total. The Soviet share rose to over 2 percent in 1978 and 1979, before declining to approximately the 1970 share in 1980. Given the structure of Soviet exports, its role as an exporter of high technology products to Western markets is undoubtedly even smaller.

Thus, the Soviet Union is a relatively small-time player in the international game of high-technology trade. Moreover, even its fledgling attempt to expand trade in high-technology products has been beset by formidable problems which some observers believe have given Soviet economic planners second thoughts about the prospective benefits of their new approach to high-technology trade. The following sections of this paper describe trends in Soviet imports of Western technology and exports of manufactured goods to the West. The paper also discusses the evidence that the new Soviet foreign trade strategy has not yielded the expected benefits and that problems associated with high-technology trade are leading to a Soviet reevaluation of the basic strategy. The paper devotes special attention to Western analyses of the problem of individual Soviet projects or industries in assimilating Western technology and using such technology to expand exports to the West.

TRENDS IN SOVIET IMPORTS OF TECHNOLOGY

Commercial technologies are most often transferred either embodied in modern machinery and equipment or in the form of accompanying technical and managerial assistance, including licenses, technical specifications, training, startup assistance, and servicing. Since complementary technical assistance is frequently included in the price of machinery and equipment exports, total technology transfers are often measured, albeit imperfectly, as the value of machinery and equipment exports. The statistics on Soviet machinery and equipment imports from the West show clearly the trend toward greater reliance on Western technology.

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[4] Martens, John A. Quantification of Western Exports of High-Technology Products to Communist Countries. U.S. Department of Commerce, Trade Information and Analysis Staff Papers, Project No. D-41. February 1982. p. 6.

Table 1 shows three different measures of Soviet imports of high-technology products from the West during the 1970s and early 1980s. The first column shows estimates, provided by Wharton Econometric Forecasting Associates, of Soviet imports of machinery from the West. (The values of machinery imports are based on a realistic conversion rate for ruble machinery trade, which is much lower than the official dollar/ruble exchange rate.) The second column is a compilation of reported Soviet machinery orders from the West, prepared initially by Paul G. Ericson and Ronald S. Miller and updated by the Economist Intelligence Unit. The third is John A. Martens' calculation of Western high-technology exports (defined as a selected group of items from Standard International Trade Classification categories 7 and 86) to the Soviet Union. Thus, the third column is a more selective measure than the first column of Soviet imports: it omits some machinery purchases that the author does not consider to be high technology. (The reader is referred to the original studies for methodological details.)

While the values in the three columns of Table 1 are different, they reflect the same basic patterns of Soviet imports of technology from the West: (1) a rapid increase in the early-and mid-1970s; (2) reduced growth, or a reduction in real terms, in the late 1970s and 1980; and, (3) some evidence of a resurgence in 1981.

TABLE 1.—MEASURES OF SOVIET IMPORTS OF HIGH-TECHNOLOGY PRODUCTS FROM THE WEST

[In million current dollars]

	Machinery imports [1]	Machinery orders [2]	High-technology imports [3]
1970	([4])	500	403
1971	1,032	850	([4])
1972	1,355	1,700	([4])
1973	1,934	2,600	([4])
1974	2,542	4,300	1,059
1975	4,977	4,650	1,615
1976	5,804	5,990	1,690
1977	6,164	3,800	2,085
1978	7,034	3,800	2,345
1979	6,867	2,600	2,371
1980	7,086	2,500	2,330
1981	[5] 7,200	5,920	([4])

[1] Wharton Econometric Forecasting Associates. Centrally Planned Economies Current Analysis. Soviet and East European Imports of Machinery From the West, January 29, 1980, p. 3.

[2] Paul G. Ericson and Ronald S. Miller. Soviet Foreign Economic Behavior: A Balance of Payments Perspective. Joint Economic Committee. Soviet Economy in a Time of Change. Volume 2. Washington, U.S. Govt. Print. Off., October 10, 1979, p. 243. Updated by The Economist Intelligence Unit Ltd. Quarterly Economic Review of the USSR. 2nd Quarter 1982, p. 17.

[3] John A. Martens. Quantification of Western Exports of High-Technology Products to Communist Countries. U.S. Department of Commerce, Trade Information and Analysis Staff Papers, Project No. D–41, February 1982, p. 9. (Data for earlier years obtained directly from the Department of Commerce.)

[4] Estimate not available.

[5] Preliminary estimate.

It is important to note that, while sales of machinery or high-technology products are an important mechanism for Western technology transfer to the Soviet Union, they are by no means the only significant one. If one could accurately measure the value of Soviet acquisition of technology through such other channels as purchases of licenses, technical data, books and periodicals, participation in scientific and technological exchange programs, attendance at foreign conferences and seminars, study at foreign universities, and industrial espionage, the total values of technology transfer would be significantly higher. Unfortunately, such technology transfers are not easily measured. To the extent that they have been examined,[5] the evidence seems to suggest a pattern that is broadly similar to the pattern of Soviet machinery imports from the West. In particular, there is evidence of a growing Soviet interest in importing Western technology and a concentration of technology imports in certain high-priority industrial sectors.

A wide spectrum of Soviet industries has benefited from imports of Western technology, but a few have received special priority. As shown in Table 2, the chemical, automotive, and oil and gas industries have received special priority as beneficiaries of Western machinery. (Soviet automotive plants are the end-users of much of the machinery identified in the metal working and metallurgy category.) The Soviet electronics, shipping, mining and construction, timber and wood industries have also been important recipients.[6]

TABLE 2.—U.S.S.R.: MACHINERY ORDERS PLACED WITH HARD CURRENCY COUNTRIES

[Millions of U.S. dollars]

	1976	1977	1978	1979[1]
Chemical and petrochemical	1,818	1,628	902	607
Oil and natural gas	1,688	308	832	190
Metal working and metallurgy	1,028	641	348	752
Timber and wood	146	65	86	56
Automotive	355	183	115	184
Ships and port equipment	283	67	127	61
Food processing	63	155	17	24
Mining and construction	120	147	118	149
Manufacturing of consumer goods	121	78	44	12
Electronics	55	193	179	335
Electricity	63	138	6	30
Other	251	213	29	212
Total	5,991	3,816	2,803	2,612

[1] Estimated.

Source: U.S. Central Intelligence Agency. National Foreign Assessment Center. The Soviet Economy in 1978–79 and Prospects for 1980, p. 17. ER-80-10328. June 1980.

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[5] See, for example: U.S. Central Intelligence Agency. Soviet Acquisition of Western Technology. In remarks of Senator William L. Armstrong. Congressional Record (daily ed.), vol. 128, May 19, 1982, S5589–S5594; Philip Hanson. Trade and Technology in Soviet-Western Relations. New York, Columbia University Press, 1981. p. 131–133; and Theriot, Lawrence, H. U.S. Governmental and Private Industry Cooperation with the Soviet Union in the Fields of Science and Technology. In U.S. Congress. Joint Economic Committee. Soviet Economy in a New Perspective. Washington, U.S. Govt. Printing Off., October 14, 1976. p. 739–766.

[6] The data on Soviet machinery orders by sector (in Table 2), originally published by the National Foreign Assessment Center of the U.S. Central Intelligence Agency, have not been published for years after 1979. The Economist Intelligence Unit, Ltd., however, continues to track major Soviet machinery orders in its Quarterly Economic Review of the USSR.

In contrast, some Soviet industrial sectors have benefited relatively little from Western technology. Philip Hanson, comparing Soviet purchases of Western machinery with total Soviet investment in various sectors, identifies the agricultural sector, electricity, steel, food processing, and building materials industries as examples of industries which have had "low import dependence." [7] Overall, Hanson estimates that imports from the West accounted for approximately 5.5 percent of total Soviet investment in machinery and equipment during the middle to late 1970s, an increase from about 2 percent in the mid-1950s. For individual industries, the contribution of Western machinery varies dramatically, from a negligible amount in some industries to as much as one-third of total investment in the chemical industry in 1976.[8]

In studying trends in Western technology transfer to the Soviet Union, the chemical, automotive, oil and gas industries are particularly noteworthy. While many other Soviet industries have imported Western machinery and equipment, these have been by far the biggest users. They accounted for much of the rapid expansion in the 1960s and early 1970s and appear to have accounted for much of the retrenchment in technology imports in the late 1970s.

The role of Western technology has been perhaps most striking in the chemical industry. Soviet importers first imported significant amounts of Western chemical plant and equipment in the late 1950s and then rapidly expanded their purchases in the 1960s and 1970s. As a result, a major portion of Soviet production of complex fertilizers, man-made fibers and other chemicals is currently being produced in plants imported from the West.[9] Between 1976 and 1979, however, there was a dramatic reduction in Soviet orders of Western plants and machinery for the chemical industry: 1979 orders were approximately one-third of the value of 1976 orders.

The Soviet automotive industry began a major modernization drive, based largely on Western technology, in the mid-1960s. The industry imported huge amounts of machinery, equipment and know-how for two major projects: the Volga Automobile Plant (VAZ), built with the assistance of the Italian firm, FIAT, and other Western companies in the late 1960s, and the Kama River Truck Plant (KamAZ), begun in the early 1970s with inputs from a number of Western companies. Purchases of Western technology for VAZ exceeded $350 million and for KamAZ, $1 billion. Soviet importers continue to purchase Western machinery and equipment for modernization and expansion of other Soviet automotive plants and reequipment of VAZ. Orders declined significantly, however, after completion of the major purchases for KamAZ.[10]

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[7] Hanson, Trade and technology in Soviet-Western relations. p. 136.

[8] Ibid., p. 128, 138.

[9] U.S. Central Intelligence Agency. National Foreign Assessment Center. Soviet Chemical Equipment Purchases from the West: Impact on Production and Foreign Trade. ER 78-10554. Washington, October 1978.

[10] For details, see U.S. Central Intelligence Agency, National Foreign Assessment Center. U.S.S.R.: Role of Foreign Technology in the Development of the Motor Vehicle Industry. ER 79-10554. Washington, October 1979; and Holliday, Technology Transfer to the USSR, p. 137-170.

The Soviet oil and natural gas industries sharply increased their imports of Western machinery and equipment in the 1970s, partially as a result of the relaxation of Western export controls and partially as a result of the rapid expansion of the industries into Siberian permafrost regions and offshore developments. As shown in Table 2, Soviet orders of machinery for the oil and gas industries also declined between 1976 and 1979. (The data actually understate the contribution of Western technology to the Soviet oil and gas industries. If one includes Soviet purchases of Western pipeline and equipment, which are not included in the compilation of Table 2, the contribution is significantly larger. For 1979 alone, the Soviet Union purchased Western machinery and equipment valued at approximately $2.7 billion for the oil and gas industries.)[11]

Thus, Soviet efforts to expand and modernize selected industrial sectors generated most of the demand for imported technology in the 1960s and 1970s. To some extent, imports of Western machinery and equipment grew rapidly because of decisions to expand key Soviet sectors in a relatively short period of time. Domestic suppliers to the chemical, automotive, oil and gas industries, for example, simply could not produce enough to keep pace with the demands of new projects in their industries. An equally important motivation was the realization among Soviet economic planners that technologically more advanced Western machinery and equipment could provide a major boost to the modernization of their industries. As noted above, Soviet officials were also motivated by a desire to establish modern, competitive export industries.

A REAPPRAISAL OF TECHOLOGY IMPORT POLICY

Table 2 reveals a decline in Soviet machinery orders for most industries between 1976 and 1979. The mining and construction and electronics categories are notable exceptions. The general decline in Soviet machinery orders continued in 1980, but was sharply reversed in 1981. (See Table 1.) The reversal was caused primarily by large orders for the Siberian-West European natural gas pipeline. Despite the resurgence in 1981, the apparent end of the rapid expansion of Soviet technology trade with the West that had been experienced in the 1960s and 1970s has led some Western observers to question whether another basic change in Soviet trade policy is occurring. In particular, it has been suggested that a significant number of Soviet officials are disappointed with the results of the technology import strategy and that a basic reappraisal of the strategy is underway.[12]

To what extent have Soviet planners realized the benefits they expected from increased imports of Western technology? Certainly there have been notable successes. It is difficult to imagine the rapid expansion and modernization of the Soviet automotive and chemical industries, for example, without imports of Western technology. At best, such a transformation would have required much more time and the expenditure of significantly more domestic resources. While it is difficult to gauge official Soviet attitudes, it seems likely that most of the leadership share this basic assessment. It is clear, however, that there are differences of opinion among Soviet officials about the degree to which Soviet industries should rely on Western technology. Indeed, there is evidence that an important debate is taking place among Soviet officials about the wisdom of continuing to allocate large amounts of hard currency to the importation of Western technology.

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[11] U.S. Congress. Office of Technology Assessment. Techology and Soviet Energy Availability. Washington, U.S. Govt. Print. Off., 1981. p. 10.

[12] See, for example, Economist Intelligence Unit Ltd. Quarterly Economic Review of the USSR. No. 4, 1979. p. 17. Also No. 3, 1980. pp. 15–16, and No. 3, 1981. p. 19. Hanson, Philip. A Backlash Against Technology Imports? Radio Liberty Research, RL 453/81, November 12, 1981.

The debate over technology import policy has surfaced in the form of articles in the Soviet press and statements by Soviet officials criticizing aspects of the current policy. The arguments of those who oppose the expansion of technology imports from the West have been described in detail elsewhere.[13] In brief, the critics complain that Soviet industry officials are frequently importing foreign technologies that are no better than, or inferior to, domestic technologies. Examples are cited of domestically produced machinery and equipment which could have accomplished a task better than the imported ones. The critics also charge that much imported machinery is being used inefficiently. In some cases, they maintain, it is not installed in a timely fashion or never put into use at all. Some Soviet importers are accused of squandering scarce hard currency or gold, which could presumably be put to better use.

Those who are critical of technology import practices include journalists, industry officials and some of the top political leadership. Even General Secretary Leonid Brezhnev, who in the early 1970s had supported an expansion of commercial and technological ties to the West, joined the critics in his report to the Twenty-sixth Party Congress in February 1981:

> We must go into the reasons why we sometimes lose our lead (in a technology), spend large sums of money on purchasing abroad equipment and technology that we are fully able to make for ourselves, often indeed at a higher level of quality.[14][15]

To put this debate in perspective, it should be noted that disagreements among the Soviet elite over technology import policies are not new. Indeed, from the beginning of the new orientation in the 1960s, the policy of expanding trade with the West was criticized in the Soviet Union. The disagreements were voiced overtly in the 1960s, but were muted in the early 1970s when Brezhnev actively supported a policy of détente. The earlier criticisms were similar to the current ones.[16] What is perhaps new is the blunt tone and general prominence of the current critics.

PROBLEMS IN ASSIMILATING WESTERN TECHNOLOGY

The complaints about waste and inefficiency in Soviet technology import practices may be somewhat exaggerated. There is, however, substantial evidence that the assimilation of Western technology in the Soviet Union has been slow and inefficient. A number of Western case studies of Western technology transfer to individual projects or industries in the Soviet Union suggest strongly that major shortcomings in the Soviet industrial infrastructure, political and economic institutions, and foreign trade practices have created formidable barriers to the effective utilization of Western technology.[17a]

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[13] Hanson, A Backlash Against Technology Imports.

[14][15] Cited in Hanson "A Backlash Against Technology Imports," p. 4.

[16] For an analysis of the debate during the period 1965–1975, see Parrott, Bruce. Soviet Technological Progress and Western Technology Transfer to the U.S.S.R.: An Analysis of Soviet Attitudes. Prepared for the U.S. Department of State, Office of External Research, Bureau of Intelligence and Research. July 1978.

The case studies, some of which are based on interviews of Western corporate executives who have had experience in selling technology to the Soviet Union, provide valuable insights into the assimilative capacity of the Soviet economy. Assimilative capacity refers to the ability of Soviet enterprises to import and put into operation foreign technologies and diffuse then to other parts of the economy. Specifically, the studies provide information on lead-times (the time taken to acquire, install and begin operating imported equipment), operation of the imported technology after start-up, and the rate of diffusion in the Soviet economy.

Most of the case studies which analyze lead-times conclude that Western-assisted projects in the Soviet economy are chronically slow in beginning operation. For example, one survey of British companies supplying machine-tools to Soviet enterprises (many of them in the automotive industry) found substantial delays in every phase of the technology transfer process—negotiations, installation and commissioning. The authors conclude that overall lead-times for supplying machine-tools to Soviet projects are probably between two and three times the expected time spans for projects in the West. The study reaches similar conclusions for the Soviet chemical industry: British suppliers of 26 turnkey chemical plants to the Soviet Union reported that the transactions took an average of six years, 10 months—about three and one-half to four times longer than West European projects normally require.[17b] A similar survey of West German companies involved in transferring technology to the Soviet metallurgical, chemical, food and packaging industries also finds unusually long lead-times for Soviet projects.[18]

Western case studies also provide evidence that, compared with performance in Western countries, imported Western technology is used inefficiently after start-up in the Soviet Union. For example, the authors of the survey of British exporters provide estimates of manning levels and output for thirteen of the chemical plants in their survey. They conclude that the average manning levels of the plants in the Soviet Union exceeded West European levels by 50 to 70 percent. Nine of the plants were determined to be operating at output levels lower than would be expected in the West; three at about the same level; and one contract (relating to four plants) was believed to be generating output at levels above similar plants in

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[17a] These case studies are surveyed in Holliday, George D. Transfer of Technology from West to East: A Survey of Sectoral Case Studies. Report prepared for the Organisation for Economic Co-operation and Development, Paris, July 28, 1982. (Working paper.)

[17b] Hanson, Philip and Malcolm R. Hill. Soviet Absorption of Western Technology, A Survey of West European Experience (Report on the Survey of U.K. Exporters). Stanford Research Institute December 1978. A shorter version is published under the title, Soviet Assimilation of Western Technology: A Survey of U.K. Exporters' Experience. In U.S. Congress, Joint Economic Committee. Soviet Economy in a Time of Change. 96th Congress, 1st session. Washington, U.S. Govt. Print. Off., October 10, 1979. p. 582–604

[18] Rothlingshofer, Karl Ch. and Heinrich Vogel. Soviet Absorption of Western Technology. Report for the Stanford Research Institute. March 1979.

Western Europe.[19] The West German survey concludes that the level of manning was an estimated 20 percent higher than for similar plants in the West and that the rate of capacity utilization, about 80 percent of West European levels. The authors speculate that labor productivity at the Soviet plants was about two-thirds of what would be expected in the West.[20]

Another indicator of the poor assimilation of Western technology is the apparent difficulty of Soviet enterprises in diffusing the imported technology to other parts of the economy. A study of Western technology transfers to the Soviet chemical industry, for example, concludes that the Soviet chemical firms have not been able to copy Western chemical equipment on a substantial scale. According to the study, while Soviet users could probably produce spare parts for some of the plants, the industry tended to go back to Western suppliers when new plants were needed.[21] Another study, of the Soviet automotive industry, finds little evidence of diffusion of the massive amounts of Western technology purchased for the Volga Automobile Plant and the Kama River Truck Plant. Instead, the study finds a tendency for other Soviet automobile plants to buy similar technologies from the same Western suppliers.[22]

The case studies provide evidence that, while Soviet assimilative capacity is poor compared to Western industrial countries, Soviet industries still receive significant benefits from imports of Western technology. When compared to existing Soviet plants, Western-equipped plants generally represent substantial improvements in performance. Thus, the study of Western technology transfer to the Soviet chemical industry notes that, while start-up of Western-equipped plants in the Soviet Union may be slow (it estimates 3 to 5 years after orders are placed), they are considerably faster than domestic start-up times (which average eight years).[23] The study also concludes that the Soviet chemical industry has made substantial gains in overall efficiency and product quality as a result of technology imports. As an example, it describes the experience of Western-supplied ammonia plants in the Soviet industry; imported plants use only five percent of the electric power and one-third fewer the number workers than the most recent Soviet-designed plants. During 1971-1975, average Soviet production costs for ammonia fell 8.5 percent as a result of installations of imported plants.

Nevertheless, the study of the Soviet chemical industry and other case studies conclude that the gains from imports of Western technology have come more slowly than anticipated by Soviet planners. A pervasive theme of Western assessments is that weaknesses in the Soviet economic and technological infrastructures reduce the capacity to assimilate Western technology rapidly and efficiently. The surveys of British and West German firms, for example, cite deficiencies in the construction sector (poor planning, inadequate equipment and materials); low skills of workers, engineers and managers in the construction work, installation and plant operation; poor coordination of plans and investments in related plants and industries, resulting in inadequate supplies; and inadequate research and development facilities.[24] The study of technology transfer to the Soviet chemical industry suggests that the pace of expansion of that industry may impede effective assimilation. It finds that new plants have been imported so rapidly that substantial shortages of labor and materials have developed.[25] A number of Western studies emphasize features of the Soviet economic and political systems which impede the effective assimilation of foreign technology. A study prepared for the U.S. Department of State, for example, cites the following systemic barriers to assimilation: lack of managerial incentives to innovate; the separation of research and development from the production process; barriers to travel to and from the Soviet Union; reluctance to agree to foreign direct investment and other active technology transfer arrangements; and the absence of competitive pressures on Soviet enterprises.[26]

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[19] Hanson and Hill, Soviet Absorption of Western Technology.

[20] Rothlingshofer and Vogel, Soviet Absorption of Western Technology.

[21] U.S. Central Intelligence Agency. National Foreign Assessment Center. Soviet Chemical Equipment Purchases.

[22] Young, John P. Impact of Soviet Ministry Management Practices on the Assimilation of Imported Process Technology—With Examples from the Motor Vehicle Sector. Paper presented at the Joint Annual Meeting of the Southwestern and Rocky Mountain Associations of Slavic Studies. Houston, April 13, 1978.

[23] Ibid.

EXPORT COMPETITIVENESS ON WESTERN MARKETS

Soviet imports of technology from the West are frequently tied directly to export-oriented enterprises by means of various contractual provisions for counterpurchases or product buybacks. Even when no such contractual provisions exist, Soviet industries which import Western technology frequently allocate a part of the output of Western-assisted projects for export to Western markets. Western technology has contributed to the production of both traditional Soviet exports, such as oil, gas and timber, and to exports of manufactured goods, such as chemicals, automobiles and ships.

As noted above, Soviet planners have placed particular emphasis on using Western technology to expand the role of manufactured goods in exports to the West. Exports of manufactured goods are seen as a means of promoting Soviet industrial modernization. Soviet economists have stressed both the general gains from international specialization and the special benefits from being forced to compete on international markets. International competition is seen as an important incentive to produce higher quality, more sophisticated goods.[27] The emphasis on exports of manufactured goods (as opposed to the traditional Soviet concentrationon exports of raw materials) is largely a function of the increasingly high cost of exploiting domestic natural resources. For many of the Soviet Union's traditional hard currency earners, such as oil, gas, gold and timber, new supplies must come from increasingly remote areas of Siberia.

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[24] Hanson and Hill, Soviet Absorption of Western Technology, and Rothlingshofer and Vogel, Soviet Absorption of Western Technology.

[25] U.S. Central Intelligence Agency, National Foreign Assessment Center, Soviet Chemical Equipment Purchases.

[26] Levine, Herbert S., et al. Transfer of U.S. Technology to the Soviet Union: Impact on U.S. Commercial Interests. Stanford Research Institute, Strategic Studies Center. SRI Project 3543. February 1976.

[27] Ericson, Paul. Soviet Efforts to Increase Exports of Manufactured Products to the West. In U.S. Congress, Joint Economic Committee. Soviet Economy in a New Perspective. 94th Congress, 2d session. Washington, U.S. Government Printing Office, October 14, 1976, p. 709-926.

The drive to expand the export of manufactured goods to the West has met with only limited success. Table 3 shows the top 25 Soviet exports to 17 industrial Western countries in 1978 and 1979. (The 25 categories accounted for about 84 percent of all Soviet exports to the industrial West.)

TABLE 3.—TOP 25 IMPORTS OF 17 INDUSTRIAL WESTERN COUNTRIES FROM THE U.S.S.R.

[Thousands of U.S. dollars]

	1979 rank	1979 value	Percent of total	1978 value	Percent of total
Crude petroleum	1	3,663,202	19.8	2,609,034	20.2
Distillate fuels	2	3,210,095	17.3	1,780,321	13.8
Residual fuel oils	3	1,114,520	6.0	623,785	4.8
Radioactive chemical elements	4	922,498	5.0	569,003	4.4
Gasoline	5	821,179	4.4	536,093	4.2
Natural gas	6	734,616	4.0	617,091	4.8
Saw logs, conifer	7	693,293	3.7	529,190	4.1
Saw logs, nonconifer	8	576,143	3.1	461,996	3.6
Platinum	9	391,815	2.1	220,273	1.7
Raw cotton	10	387,348	2.1	403,941	3.1
Coal	11	386,825	2.1	361,515	2.8
Diamonds	12	320,365	1.7	379,224	2.9
Passenger cars	13	268,598	1.5	176,827	1.4
Pulpwood	14	167,396	.9	127,609	1.0
Aluminum, aluminum alloys	15	158,643	.9	17.601	1.3
Ammonia	16	129,106	.7	53,290	.4
Nickel, nickel alloys	17	119,302	.6	76,200	.6
Fur skins	18	117,264	.6	89,829	.7
Iron and scrap	19	110,755	.6	58,774	.5
Ships and boats	20	82,204	.4	25,798	.2
Coke	21	72,910	.4	73,775	.6
Special purpose vessels	22	70,963	.4	8,145	.1
Potassic fertilizers	23	61,771	.3	57,941	.4
Kerosene, jet fuel	24	59,778	.3	75,057	.6
Bleached sulphate wood pulp	25	50,891	.3	44,022	.3
Total, top 25		15,524,856		10,783,424	
Total U.S.S.R. exports to 17 industrial Western countries		18,503,481		12,888,419	
Top 25 as percent of total exports to 17 industrial Western countries		83.9		83.7	

Source: Kravalis, Hedija H. U.S.S.R.: An Assessment of U.S. and Western Trade Potential with the Soviet Union Through 1985. In U.S. Congress, Joint Economic Committee. East-West Trade: The Prospects to 1985. Washington, U.S. Government Printing Office, Aug. 18, 1982, p. 315.

Table 3 shows clearly the continuing dominance of energy and other raw material exports in the Soviet Union's trade with the West. Soviet hard currency earnings from energy products benefited dramatically in the late 1970's as a result of energy price increases. Approximately 60 percent of Soviet hard currency earnings came from energy exports. Despite a favorable trend in Soviet hard currency earnings during 1979–80 (caused by increased earnings from gold and arms, as well as energy products) the outlook for the Soviet trade balance with the West is not good.[28] A central dilemma for Soviet foreign trade planners is that earnings from oil exports may stagnate or decline. Oil prices are unlikely to escalate as rapidly in the future, and the volume of oil exports may decline. Natural gas exports are likely to grow significantly, especially if the Siberian-West European Pipeline is completed. Earnings from natural gas, however, appear unlikely to compensate for the possible decline in oil earnings. Moreover, export earnings from both industries depend on continuing large imports of Western machinery and equipment.[29]

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[28] U.S. Congress. Joint Economic Committee. Subcommittee on International Trade, Finance, and Security Economics. Allocation of Resources in the Soviet Union and China—1981. Part 7, Hearings. 97th Congress, 1st session. July 8 and October 15, 1981. Washington, U.S. Govt. Print. Off., 1982. pp. 243–251.

Given the outlook for hard currency earnings from energy exports, Soviet officials are probably disappointed with export performance in their manufacturing industries. Exports of manufactured goods to the West showed only modest increases in the 1970's and still represent only a small share of total Soviet hard currency exports. In 1979, exports to the West of finished manufactured goods earned $761 million, accounting for only 4 percent of total hard currency earnings from merchandise exports. Exports of chemicals accounted for an additional 7 percent of total hard currency earnings.[30]

Of Soviet exports of finished manufactures, automobiles are the largest item, earning $269 million in 1979. Concentrating on the West European market, Soviet exporters have made a concerted effort to capture a larger share of the Western automobile market. This effort is a prime example of the Soviet strategy of using Western technology to build competitive export industries. Two-thirds of Soviet exports of passenger cars have been the Lada, a product of the Volga Automobile Plant based on FIAT technology. To promote exports of the Lada and other automobiles, Soviet exporters have taken steps to improve product designs, raise quality control standards and develop a network of distributors and service facilities in the West.[31] Still, the volume of exports is modest, and the limited success of Soviet exporters is due more to relatively low prices, than to high quality. (The Lada is priced at about 75 percent of similar Western models.[32])

As shown in Table 3, earnings from finished manufacturers other than automobiles are small. Only ships, boats and special purpose vessels, accounting for less than 1 percent of total hard currency exports, are among the top 25 hard currency exports.

Soviet exports of chemicals to the West have grown more rapidly than finished manufactured goods in recent years, but still account for only modest hard currency earnings. Exports of the largest item, radioactive chemical elements, have grown primarily because of the expansion of uranium enrichment services to several West European countries.[33] The second largest chemical export is ammonia, which grew rapidly in the late 1970s. Unlike radioactive chemical elements, which are probably produced largely on the basis of Soviet indigenous technology, ammonia exports are another example of the Soviet strategy of using Western technology to build export industries. In 1973, the Soviet government signed a contract with the U.S. firm, Occidental Petroleum Corporation, to purchase equipment and technology for nitrate fertilizer plants and pipelines for transporting liquid ammonia. In return, products from the Soviet plants—ammonia, urea and potash—are being shipped to the United States over a period of twenty years. Significant exports of ammonia from the Soviet plants began in 1978 and have expanded rapidly. Soviet exports of ammonia to the United States are expected to rise to 2.1 million tons per year.

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[29] Office of Technology Assessment. Technology and Soviet Energy Availability, pp. 19–77.

[30] Kravalis, Hedija H. USSR: An Assessment of U.S. and Western Trade Potential with the Soviet Union Through 1985. In U.S. Congress. Joint Economic Committee. East-West Trade: The Prospects to 1985. Washington, U.S. Govt. Print. Off., August 18, 1982.

[31] Holliday, Technology Transfer to the U.S.S.R., p. 152.

[32] Kravalis, An Assessment of U.S. and Western Trade Potential, p. 33.

[33] Ibid., p. 30.

Most Western observers believe that the prospects for a significant expansion of Soviet exports of finished manufactures and chemicals are not good. Three Western studies, for example, survey various possible Soviet chemical exports and conclude that relatively few chemical products are likely to be exported in significant quantities to the West.[34] All of the studies conclude that Soviet ammonia exports are likely to provide intense competition with Western producers. One study also suggests that East European (primarily Soviet) exports of soda ash and plastics may expand significantly.[35] Overall, however, the studies do not anticipate intense competitive pressures from Soviet chemical exports.

Another study of four Soviet industries—semiconductors, commercial aircraft, construction machinery and equipment, and synthetic fibers—finds that they are unlikely to pose a major competitive threat to U.S. firms.[36] At best, the study concludes, Soviet exports from these industries are likely to achieve only marginal success in a few product lines. Similarly, a U.S. Department of Commerce study finds the prospects for significantly greater Soviet hard currency earnings from chemicals and finished manufactures generally poor.[37]

A number of reasons are given by Western observers for the generally pessimistic outlook for Soviet hard currency earnings from exports of chemicals and finished manufactures. First, Soviet exports are subject to the same economic conditions, such as slow economic growth and rising protectionism, which are slowing the growth of trade throughout the West. Secondly, a number of factors related to Soviet institutions and product designs are likely to impede efforts to improve Soviet export competitiveness. Most Soviet enterprises suffer from lack of experience in marketing their products in the West. They have a reputation for poor maintenance and poor after-sales services and generally tend to be unresponsive to the special needs of potential customers in Western markets.[38] Various domestic infrastructural problems, which have contributed to poor quality standards, technological obsolescence and delays in start-up times and production schedules, are also impediments to competing in the West. Soviet products also tend to be designed for the unique conditions that exist in the Soviet economy. One Western study notes, for example, that Soviet trucks and cars are designed for unusual Soviet conditions, such as poor roads, low-octane gasoline, low-grade lubricants and cold weather. The study concludes that Soviet vehicles are not well suited for operating conditions in the West and therefore, are unlikely to be exported in large quantities.[39]

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[34] U.S. Central Intelligence Agency. National Foreign Assessment Center, Soviet Chemical Equipment Purchases; U.S. International Trade Commission. Analysis of Recent Trends in U.S. Countertrade. Washington, March 1982; and Organization for Economic Co-operation and Development. East-West Trade in Chemicals. Paris, 1980.

[35] Organisation for Economic Co-operation and Development. East-West Trade in Chemicals.

[36] Levine, et al., Transfer of U.S. Technology to the Soviet Union.

[37] U.S. Central Intelligence Agency, National Foreign Assessment Center, U.S.S.R.: Role of Foreign Technology in the Development of the Motor Vehicle Industry.

[38] Kravalis, An Assessment of U.S. and Western Trade Potential, p. 31, 34.

CONCLUSIONS AND OUTLOOK

Western case studies of technology transfer to various sectors of the Soviet economy provide substantial evidence that important elements of the new Soviet approach to trade in high technology products have had only limited success. Soviet enterprises have encountered formidable problems in assimilating Western technology and have a poor record in using that technology to generate new hard currency earnings. The Western assessments tend to mirror those of vocal critics in the Soviet hierarchy who have complained about inefficient and wasteful technology import practices. Does the acceptance of such critical assessments by the Soviet leadership explain the decline in Soviet imports of Western machinery and equipment which occurred in the late 1970s? What do these assessments portend for future Soviet trade policy?

There are no clear-cut explanations of the decline in Soviet imports of Western technology in the late 1970s. There is, however, circumstantial evidence that the problems of assimilation and export competitiveness described in this paper are important factors contributing to the decline. On the one hand, Soviet importers appear to have slowed new purchases of Western machinery and equipment because of delays in installation and starting up new plants. Such delays are a chronic problem in the Soviet domestic industry, and despite the best efforts of Soviet planners, they have also plagued projects using large amounts of Western technology. On the other hand, sluggish Soviet performance in exporting to Western markets has contributed to Soviet concerns about the Soviet Union's hard currency balance of payments and its indebtedness to Western creditors.

The chemical and automotive industries provide good examples of Soviet problems with assimilation and export competitiveness. (The chemical industry and, to a lesser extent, the automotive industry have been frequent targets of published Soviet criticisms of technology import practices.[40]) In both industries, domestic resources appear to have been inadequate to absorb the large influx of Western machinery and equipment purchased in the early and mid-1970s. A 1978 Western study of Western technology transfer to the Soviet chemical industry, for example, concluded that shortages of Soviet domestic resources, such as construction materials, experienced construction labor, and infrastructure, were probably a serious constraint on further purchases.[41] Similarly, the huge commitment of the Soviet automotive industry's resources to the Kama River Truck Plant, combined with serious delays in construction and startup, probably was a major constraint on the Soviet industry's ability to undertake large new purchases of Western automotive technology.

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[39] Levine, et al., Transfer of U.S. Technology to the Soviet Union.
[40] Hanson, A Backlash Against Technology Imports.
[41] U.S. Central Intelligence Agency, National Foreign Assessment Center, Soviet Chemical Equipment Purchases. . ., p. 4.

It is likely that such assimilation problems are only a temporary barrier to the continuing growth of Soviet imports of Western technology. While assimilative difficulties will not disappear, Soviet needs for Western technology are likely to persist. Western assessments suggest that Soviet recipients have reaped significant benefits from Western technology and that technology imports are likely to play an important role in future modernization efforts. Most Western case studies suggest continued dependence on Western technology for key sectors of the Soviet economy. The Soviet natural gas industry's dependence on Western technology, for example, is likely to increase during the 1980s.[42] Indeed, the resurgence of Soviet orders of Western machinery and equipment in 1981 (see Table 1) is in large part due to developments in the gas industry. Western assessments also suggest continued large imports for the Soviet oil industry.[43] Most case studies of the Soviet chemical and automotive industries also suggest continued dependence on Western technology as Soviet purchasers go back to Western suppliers for new generations of technology.[44]

Current and prospective weaknesses in Soviet export performance, which contribute to the hard currency payments problem, may be a more permanent constraint on technology imports. Despite a favorable trend in the Soviet terms of trade with the West in the late 1970s, the Soviet Union faces problems in exporting enough to pay for needed imports of Western technology and grain. Most Western assessments conclude that Soviet exporters of manufactured goods will have continuing difficulties in penetrating Western markets. Consequently, the key to Soviet hard currency earnings is likely to be traditional exports of raw materials and semi-processed goods. Particularly important will be the ability of the Soviet oil and gas industry to produce large exportable, surpluses.

While the focus of this paper is on Soviet assimilative capacity and export competitiveness, it is clear that other factors contribute to variations in Soviet imports of Western technology.[45] Trends in domestic economic growth and capital investments, for example, directly influence the need for imported machinery and equipment. The international political environment is probably also an important factor. Western trade sanctions and Soviet reactions to them probably dampen the Soviet appetite for expanded trade with the West.

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[42] Office of Technology Assessment, Technology and Soviet Energy, Availability; and U.S. Central Intelligence Agency. National Foreign Assessment Center. U.S.S.R.: Development of the Gas Industry. ER 78-10393. Washington, July 1978.

[43] U.S. Central Intelligence Agency. National Foreign Assessment Center. Prospects for Soviet Oil Production. ER 77-10270. Washington, April 1977; and Office of Technology Assessment, Technology and Soviet Energy Availability.

[44] See, for example, Hanson and Hill, op. cit.; U.S. Central Intelligence Agency, National Foreign Assessment Center, Soviet Chemical Equipment Purchases; Holliday, op. cit.; and John P. Young, Impact of Soviet Ministry Management Practices on the Assimilation of Imported Process Technology. For a contrasting view on the Soviet automotive industry's future dependence on Western technology, see U.S. Central Intelligence Agency. National Foreign Assessment Center, U.S.S.R.: Role of Foreign Technology in the Development of the Motor Vehicle Industry.

[45] Wharton Econometric Forecasting Associates. Centrally Planned Economics, Current Analysis. Soviet and East European Imports of Machinery from the West. Jan. 29, 1982.

None of these factors, however, provide strong evidence of a fundamental change in attitude on the part of Soviet decision-makers about the desirability of importing technology. While there have always been opponents in the Soviet hierarchy to the policy of expanding commercial relations with the West, they do not appear to be a dominant force. A more likely explanation for the prominence of the critics of Soviet technology import practices is the sheer increase in the volume of imports from the West and the inevitable increase in waste and inefficiency associated with the larger volume. Critics of the current policy have more opportunities to criticize.

The basic Soviet economic rationale for relying more heavily on Western technology has not changed. Indeed, increasing scarcities of labor, capital and materials are likely to make the rationale even more compelling in the mid and late 1980's.

SOVIET PATENTS AND INVENTORS' CERTIFICATES

By John A. Martens*

CONTENTS

		Page
I.	Introduction: Patents West and East	531
II.	Socialist Principles for Organizing and Managing Inventing	532
III.	The Organizational Development of Soviet Inventing	534
	A. Primary Organizations within the State Committee for Inventions and Discoveries	534
	B. Organizations Not Directly Subordinate to the State Committee for Inventions and Discoveries	536
IV.	Soviet Motives for Establishing a Patent-Inventor's Certificate System	537
	A. Attracting Western Technology	537
	B. Developing Soviets Exports	538
	C. Following Western Industrial Trends	539

I. INTRODUCTION: PATENTS WEST AND EAST

The large resources devoted by Western firms to obtaining patent protection for many of their new technical developments reflect the continuing importance of patents in Western commerce. While economists often argue about the actual economic effects of granting patents, businesses still view patents as important protection for many of their investments in the development of new products and processes. Without adequate patent protection, businesses would likely forego investments in projects which are readily copied by competitors. Thus, a patent's grant of an exclusive right "to make, use or sell" new technical developments and the ability to enforce this right legally are important incentives for a Western firms' commitment to continue broad research and development programs. Furthermore, the establishment of reasonably strong patent protection by all industrialized Western governments reflects a general belief in the overall economic merit of maintaining patent systems.[1]

The establishment of patent protection in the Soviet Union arose from economic concerns quite different from those traditionally found in Western countries. In fact, patent protection as it had existed in Tsarist Russia was at first completely abolished by a decree signed by Lenin. From this decree it is evident that early Soviet officials viewed patents as remnants of the old capitalist economic order. These Soviet officials reasoned that socialism, by concentrating the means of production in the hands of the state and by financing industrial R & D programs, should strive for a system which freely shares new technology among enterprises. What need then for any exclusive rights at all? More appropriate is building a system that recognizes the technical creativity of the state's employees and disseminates efficiently new innovations.

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[1] N.b.: A company must file for a patent in each country where it needs patent protection. A U.S. patent, for example, provides no legal protection for an invention outside of the United States.

Economic realities quickly overcame early revolutionary optimism. The new Bolshevik led government instituted a Concessions Policy and subsequently a New Economic Policy to attract foreign technology and expand trade. Directly linked to the implementation of these economic policies was the reestablishment of the patent system. Soviet officials realized that socialist economic development would be a lengthy process and that Soviet industry could still benefit greatly from access to Western technology. Furthermore, foreigners, it was now admitted, would only sell much of their technology to the Soviet state if adequate patent protection were available.

The reintroduction of a patent system did not, however, signal a complete embracing of this typically capitalist economic institution. With the advent of state economic planning, a new socialist institution, the inventor's certificate (avtorskoe svidetel'stvo), was created.[2] Inventors' certificates became, in effect, the socialist answer to the ideological problems inherent in patents. Nevertheless, the onset of preparations for war in 1936 and the relative backwardness of Soviet industry effectively postponed a genuine development of this new socialist institution. After World War II such a development became possible. Soviet investments in science and engineering grew precipitously, and the Soviet economy now needed increasingly more sophisticated technological developments for sustained growth. Thus, Soviet economic officials once more became interested in patents and in the development of a socialist invention system.

The present article summarizes the post-Stalin developments in the Soviet system for the management of inventions. In particular, the article points out that the present "patent-inventor's certificate" system has grown beyond its original purpose of attracting foreign technology and is now integrally linked to Soviet desires to become an international economic power and to Soviet programs that carefully follow Western scientific and technological developments. First, the general socialist principles for managing inventing are outlined and put into an ideological perspective. Second, the organizational framework for inventing is described. Lastly, three important motives for the recent large Soviet investments in establishiing a patent-inventor's certificate are given.

II. SOCIALIST PRINCIPLES FOR ORGANIZING AND MANAGING INVENTING

The primary function of most Western patent offices centers on the processing of patent applications and the publication of the relevant technical documentation. Claim drafting, patent searches, licensing proposals, industrial implementation of valuable inventions, money for the inventor and the dissemination of technical information to factories usually are accomplished by private firms.

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[2] An inventor's certificate is similar to a patent in most respects except that no exclusive rights are granted to the inventor. Instead, the rights to use the invention belong to the state, and in return the state obligates itself to reward the inventor if his invention is used.

Socialism demands more of its patent office. Thus, the present Soviet State Committee for Inventions and Discoveries (Goskomizobretenii) is intricately involved with inventions, from their very inception until their industrial use. This broader involvement requires that, in addition to carrying out the traditional duties of a patent office,[3] the Soviet State Committee carry out such varied tasks as:

> Promoting the use of new inventions in industrial enterprises, including recommendations that specific inventions be included in ministerial plans;
>
> Establishing a general social awareness of the economic importance of inventing, such as raising the "patent consciousness" of industrial officials;
>
> Organizing, translating, and distributing foreign patent literature to industrial enterprises;
>
> Organizing and managing numerous local depositories of patent literature throughout the Soviet Union;
>
> Providing training to industrial research personnel in the legal, technical and information science aspects of patenting;
>
> Providing a centralized system through which bonuses are paid to inventors whose inventions are used;
>
> Aiding industrial enterprises in verifying that proposed exports will not infringe on foreign patents; and
>
> Recommending that specific inventions be approved or rejected for patenting abroad.

A number of the above tasks require coordination with other state agencies, and the actual power of the State committee in its relations with other agencies still seems quite limited. Whether or not the State Committee can force other agencies, especially industrial ministries, to follow its views on managing inventing and on the use of new technologies was in the past a thorny issue.[4] Presently, the State Committee merely recommends—primarily to the State Committee for Science and Technology, Gosplan, Gosstandart, industrial ministeries, and other scientific organizations—that specific inventions be implemented.[5] The State Committee can, however, compel other state agencies to follow its guidelines for formulating inventors' certificates, organizing patent departments, submitting statistical reports, etc. Furthermore, as inventions—e.g., number of applications, number of grants, number implemented, etc.—are increasingly used by economic officials to measure the quality of a research institute's or enterprise's technical developments, the power of the State Committee, the final arbiter in deciding patentability, will correspondingly grow. However, the present State Committee, in largely providing technical opinions which are drawn from an immense collection of international and domestic patent literature, remains primarily a consulting agency for other state organizations.

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[3] Goskomizobretenii, as do many Western patent offices, also has the responsibility of managing industrial designs and trademarks. Furthermore, it administers a system for registering scientific discoveries.

[4] During the 1930's and early 1960's the Committee for Inventing was much more powerful and could force a Ministry or enterprise to implement a specific invention. Attempts at regaining this power appear to have failed.

[5] See "O dal'neishem razvitii izobretatel'skogo dela v strane, uluchshenii ispol'zovaniya v narodnom khozyaistv otkrytii, izobretenii i ratsionalizatorskikh predlozhenii i povyshenii ikh roli v uskorenii nauchnotekhnicheskogo progressa," Postanovlenie Tsentral'nogo Komiteta KPSS i Soveta Minstrov SSSR et 20 Avgusta 1973 g. No. 575.

While a Western industrialist might pale at the though of his government being responsible for the efficient management of all of the above mentioned tasks, Soviet economic officials believe that only by such a degree of state involvement can technological developments become efficiently used. Soviet ideology, in fact, presently leaves little room for any change in these beliefs. Strong central planning, socialist views on the use of state property, and the presently organized state monopoly of foreign trade effectively prohibit Soviet enterprises or research institutes from wheeling and dealing in technology. For example, while R & D institutes may conclude contracts with industrial enterprises and can charge for the transfer of new technologies, the profitability of these ventures is strictly limited by the state and remains quite low.[6] State planners probably fear the capricious or "stiknihyi" effect of an enterprises's ability to accumulate unplanned economic power through the clever development of a technological strategy. Socialist "superprofits" are, as of yet, unthinkable. Consequently, the Soviet management of inventing will be forced to continue its search for efficiency through a high degree of state involvement.

III. THE ORGANIZATIONAL DEVELOPMENT OF SOVIET INVENTING

The present State Committee for Inventions and Discoveries recaptured its stature as an independent governmental agency in fits and starts. During World War II the management of inventing was conducted by a part of Gosplan. Shortly after the end of World War II, the Committee was once again made an independent body, only to be subsumed four years later under the newly formed Gostekhnika. Finally in 1955 the Committee for Inventions was again made independent. While the reasons for these early changes remain unclear, the Committee has subsequently grown steadily in importance, being elevated in 1973 to the rank of State Committee.

A. The primary organizations within the State Committee are as follows:

1. *Vsesoyuznyi nauchnoissledovatel'skii institut gosudarstvennoi patentnoi ekspertiza (VNIIGPE).* (The All-Union Scientific Research Institute of State Patent Examination). Formed in 1960, this organization corresponds most closely with the work done in Western patent offices. VNIIGPE must examine all applications for investors' certificates, patents, industrial designs and trademarks and decide whether or not the applications meet the standards established by law. The work load is significant—well over 100,000 applications annually—and has caused some discussion about changing to a less rigourous examination procedure, i.e., one similar to that in the F.R.G. In addition to the traditional function of patent examination,

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[6] A published model contract (typovyi dogovor) allows only the recoupment of some development expenses. Postanovlenie No. 530 of the GKT (Dec. 31, 1971), with collaboration by Gosplan, Ministry of Finance and Ministry of Justice.

VNIIGPE employees are expected to signal promising inventions to potential industrial users.

2. *Vsesoyuznaya patentonotekhnicheskaya biblioteka (VPTB).* (The All-Union Patent-Technical Library.) Similar to its counterparts in the West, the library collects both legal literature and the full specifications from foreign and domestic grants of patents or inventors' certificates.

3. *Nauchno-Proizvodstvennoe Ob'edinenie "Poisk".* (The Scientific Production Association "Search"). This NPO was created in 1975 by joining together the following three organizations:

a. Vsesoyuznyi nauchnoissledovatel'skii institut patentnoi informatsii (VNIIPI).[7] (The All-Union Scientific Research Institute for Patent Information). This organization is the research and policy arm of the State Committee and studies:

the development and use of patent information;
the economics of inventing;
foreign and domestic legal issues;
the automation of patent and technical economic information, including machine translation; [8]
the dissemination of scientific information; and
maintenance of international cooperation in industrial property.

VNIIPI's main role is to act as a coordinating center for all types of scientific work with patent information, thus helping standardize the practices of enterprises and scientific research organizations.

b. Informatsionno-vychislitel'nyi tsentr (IVTs). (Computerized Information Center). This center puts Soviet invention data into machine readable form and maintains the NPO's computerized data base of foreign patent information, largely INPADOC tapes.[9]

c. Proizvodstvenno-poligraficheskoe predpriyatie "Patent". (The Industrial Printing Enterprise "Patent"). The enterprise "Patent" is essentially the State Committee's own publishing house. It prints numerous small editions, among which the most important are the research works from the State Committee's employees, narrowly focused "express information" bulletins, and digests of Western patents. The enterprise "Patent" has branches in Leningrad, Tallin, Tbilisi, Uzhgorod and Khar'kov.

4. Vsesoyuznyi tsentr patentnykh uslug (VTsPU). (The All-Union Center of Patent Services). This center is the commercial arm of the State Committee. For an established fee, VTsPU will provide:

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[7] This organization was formerly named TsNIIPI, Tsentral'nyi nauchnoissledovatel'skii institut patentnoi informatsii i tekhniko-ekonomicheskikh issledovanii.

[8] On machine translation see, for example, S.M. Shevenko, "Avtomaticheskii perevod yaponskikh patentnykh opisanii," *Voprosy izobretatel'stva,* 1967, No. 8 pp. 45–42.

[9] International Patent Documentation Center. An organization, subordinate to the Austrian finance Ministry, through which member countries share their machine-readable patent information.

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patent searches for ministries and scientific organizations on questions relating to the technical level of products or processes;

conventional patent searches for both domestic and foreign customers;

help in claim drafting for inventors; and

a check for possible infringement problems connected with Soviet exports or planned industrial developments.

5. *Upravlenie po okhrane prav izobretatelei i tsentralizovannoi vyplate voznagrazhdenii (UTsVV).* (The Administration for the Protection of the Rights of Inventors and the Centralized Payment of Rewards.) Since establishment of the inventor's certificate in 1931, the Soviet press has consistently reported on case after case of red tape surrounding the payment of proper bonuses to investors. Yet, financial incentives have an important role to play in furthering the creation and use of new technologies. Consequently, in 1974 the State Committee started to form a central office for a more efficient handling of financial rewards. Theoretically, since all enterprises and state organizations must report each invention used to the State Committee, the UTsVV simply checks these forms, verifies the names and pays out the bonuses directly. In practice, however, a number of problems have prevented the full implementation of this system, not the least of which is determining the proper size of the reward.

6. *Tsentral'nyi Institut Povysheniya Kvalifikatsii Komiteta. (TsIPK).* (The State Committee's Central Institute for Training Patent Specialists). In meeting the need to have highly specialized cadres for the management of the State's invention programs, the State Committee established a central institute in 1968. This institute includes both a two year correspondence course (which was completed by over 5,200 specialist during the 10th five year plan) and a several month fulltime course. The curriculum includes such topics as: examination procedures and claim drafting; economics and the ogranization of inventing; patent information (e.g., searching and technological forecasting); avoiding infringement in international trade; and patent laws. Almost every major Soviet scientific research institute or industrial enterprise now has some employees trained by TsIPK.

B. Organizations outside the direct management of the State Committee:

There are several organizations outside the direct supervision of the State Committee which play an essential role in managing Soviet inventing. The most important of these are:

1. *Vsesoyuznoe obshchestvo izobretatelei i ratsionalizatorov. (VOIR).* (The All-Union Society of Inventors and Rationalizers).[10] VOIR is a voluntary organization of State employees interested in technical innovation. It is managed by the VTsSPS, or trade unions. Regional VOIR organizations are

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[10] The Soviet term "rationalizator" does not translate easily. A "rationalizer" is a person who makes technical suggestions for the improvement of industry. The suggestions do not have to be patentable.

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only two steps removed from the Obkom Council of Economic and Social Development. Thus, VOIR is a clear transmission belt of Party policy on technical innovation. VOIR's primary activities center on:

organizing propaganda efforts to further all aspects of inventing and technical innovation;

helping worker-inventors and innovators get the attention of enterprise management on implementing new techniques; and

protecting the interests of innovators, primarily in securing their bonuses and other emoluments.

As of 1978, VOIR had 9,600,000 members.

2. *Patent Services in Enterprises and Research Organizations. (Patentnye sluzhby).* The Soviet press states that the first patent services were formed in 1960 at the Gor'kii Automobile Plant (GAZ) and in 1961 at the Riga Electrical Engineering Factory (VEF). The experience of these two factories served as the basis for the subsequent Council of Ministers decree in 1967,[11] which outlined how similar patent services were to be established in every major Soviet industrial and research organization. Whereas there were already 5,000 patent services in 1968, their number grew to slightly over 7,000 by 1975. A general reading of special conference reports and ministerial publications gives the clear impression that many patent services employ well-trained personnel, receive significant resources and command considerable respect from industrial managers. The activities of the patent services centers on:

verifying that a factory's production will not infringe on valid patents, either when produced or when exported;

reviewing the commerical perspectives of planned R&D themes in light of existing Soviet and foreign patents;

preparing applications for inventors' certificates; and

disseminating patent literature within the organization.

IV. SOVIET MOTIVES FOR ESTABLISHING A PATENT-INVENTOR'S CERTIFICATE SYSTEM

A. Attracting Western Technology

While sales of technology are often concluded without the transferral of patent rights, patents can substantially facilitate or increase the profitability of technology transfers. For example, the inclusion of patents in licensing agreements is often the key to gaining favorable tax advantages or to avoiding serious antitrust problems. Furthermore, patents can provide important legal protection when divulging related technical information during negotiations, and patents are often important in preventing the copying and reexport of purchased equipment. Consequently, the Soviet government quickly recognized, and continues to recognize, the value that a patent system has in aiding the purchase of foreign equipment and technology. Western firms, in their turn, quickly recognized the increased Soviet interests in purchasing Western technology and the genuine Soviet efforts at establishing acceptable patent protection. As table 1 shows, the number of Soviet patents granted rose sharply after the U.S.S.R. joined the Paris Convention [12] in 1965.

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[11] Postanovlenie Soviet Ministrov SSSR , 19 May 1967, No. 449.

TABLE 1.—*U.S.S.R. Patents Granted, 1965–79**

1965	52
1966	171
1967	507
1968	829
1969	715
1970	1,723
1971	2,001
1972	2,516
1973	2,337
1974	1,845
1975	2,295
1977	2,299
1979	2,448

*The overwhelming majority of patents are granted to Western firms.

Sources: Ye. I. Artem'ev and L. G. Kravets, *Izobreteniya-Uroven' Tekhniki-Upravlenie,* (Moscow: Isdatel'stvo "Ekinomika, 1977), p. 47 and Ye. I. Artem'ev, *Tekhnicheskii progress izobretatel'stvo; patentno-litsenzionnaya Robota,* (Moscow: Akademiya narodnogo Khozyaista SSSR, 1980), p.24.

Presently Western companies have slightly reduced their patenting in the U.S.S.R. This reduction partly reflects an overall reduction in international patenting and partly reflects a growing dissatisfaction with present trends which narrow considerably the allowable claims for certain chemical patents.[13]

B. Developing Soviet Exports

"The socialist camp, using the progress of new technology and the broad implementation of new technological processes—increasing constantly the productivity of labor—will already by the end of the Seven Year Plan (1965) produce more than 50% of total world production." [14]

The restablishment of a Soviet patent office occurred during a period of tremendous optimism about the future developments of Soviet science and the ability to put these developments to use industrially. A rapidly developing, increasingly sophisticated Soviet industry was naturally expected to take its place among the leading manufactured goods exporters of the world. However, as the Soviet government painfully discovered in the late 1950's, exporting—even as free foreign aid—requires considerable knowledge about international patent laws and practices.[15] Consequently, the post-War Soviet patent office—unlike its predecessor—began to structure itself around the government's programs for increasing

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[12] The Paris Convention is an international agreement, originally drafted in 1883, for the protection of industrial property. All major industrialized western countries are signatories.

[13] Chemical patents comprise over half of the patents granted by the U.S.S.R. Furthermore, the Ministry of the Chimical Industry (Minkhimprom) has consistently pushed for granting only very limited patent protection for foreigners, and one suspects that the present trends in VNIIGPE are a result of continued Minkhimprom pressures. On Minkhimprom's pressures, see speech by Yu. Ye. Maksarev in *Zashchita prioriteta i gosudarstvennykh interessov v oblasti otkrytii i izobretenii,* February symposium at Novosibirsk, 1969.

[14] *Tekhnicheskii progress v SSSR, 1959–1965.* (Moscow: Gosplanizdat 1960).

[15] In the late 1950's the Soviet Union gave India several locomotives as part of a foreign aid program. The locomotives, however, were discovered to contain parts patented in India by a British firm. Consequently, before the U.S.S.R. was able to give the locomotives to India, it was required to pay royalties to the British firm.

Soviet manufactured goods exports. With the establishment of patent services at each major industrial enterprise, the Soviet government began a program to have each enterprise examine carefully its products in light of the patents held by foreign firms abroad.[16] Such examinations require access to considerable amounts of international patent literature, and this literature was quickly acquired and distributed by the State Committee. Thus, at the Riga Electrical Engineering Factory "VEF", the patent service can provide computerized searches on specific technical areas and develop a relevant chart of the most significant international patents. If one of the factory's products is determined to infringe, the factory can then decide if it should license or redesign.

C. Following Western Industrial Trends

The use of patent data in following Western industrial trends appeals to Soviet economic officials because:

the information covers most important areas of industrial technology; [17]

the information comes in machine readable form via exchange with INPADOC;

the information can be easily manipulated for a number of distinct purposes—e.g., searches by industrial firm, technical area, or patent family are possible; and

the information is classified according to a system now used in the U.S.S.R. (The International Patent Classification.)

Soviet economic officials now use Western patent data as an important element in their R & D planning process. Enterprise and scientific research organizations must now conduct patent searches both prior to selecting R & D themes and during various stages of the research project itself.[18] In this manner, economic officials seek to force Soviet industrial R & D facilities to conduct work closer to present world levels. The State Committee has also expended considerable resources in investigating the utility of patent data in technological forecasting. One Soviet economist gave the following rather sanguine outlook for forecasting in his area of interest:

> The study of patent materials not only gives a completely fixed picture of the achieved level in this or that branch of science and technology, but permits the following of the tendencies in world scientific research—which is especially valuable for planning scientific research and the whole complex of patent-licensing work. Following tendencies in world research through patents also permits, in conjunction with other types of scientific-technological and economic information, the assembling of a sufficiently trustworthly forecast of world developments in instrument making over the next 5-10 years.[19]

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[16] This examination is referred to as checking for "patent purity" (patentnaya chistota). See, for example, Ukazaniya o mer'akh po obespecheniyu patentnosposobnosti i patentnoi chistoty mashin, priborov, oborudovaniya, materialov; tekhnologicheskikh protsessov. (ZP-1-64). Utverzhden Goskomizobretenii 5/XI, 1963.

[17] Computer programs and genetic engineering are, by and large, presently exceptions. The latter, however, will likely become more prevelent.

[18] These searches are now included in the State Standards covering the management of R & D.

[19] E. Ia Volynets-Russet in *"Patentno-litsenzionnaya i izobretatel'skaya rabota v organizatsiyakh i na predpriyatiyakh ispytatel'nykh mashin, priborov i sredstv izmereniya mass (materialy seminara-soveshcheniya),* (Moscow: TsNIIPI, 1967), p. 21.

In addition to aiding R & D planning and technological forecasting, patent information also plays an important role in researching potential licensors of needed Western technology and potential licensees for sales of Soviet technology. The State Committee supplies this information both to the State Committee for Science and Technology and to NIKI (Market Research Institute) of the Ministry of Foreign Trade.

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INTEGRATION OF CEMA* SCIENCE AND TECHNOLOGY

By Louvan E. Nolting**

CONTENTS

	Page
Summary	541
I. Introduction	542
II. Historical Developments of Scientific and Technical Integration in CEMA	544
III. Benefits and Problems of Scientific and Technical Integration	547

SUMMARY

Scientific and Technical cooperation among the countries of the Council for Economic Mutual Assistance (CEMA) began in the late 1940's with bilateral agreements to exchange scientific and technical information and personnel for training and technical assistance. Most of these agreements were made between the U.S.S.R. and the other CEMA countries. These early arrangements were gradually and systematically expanded since that time. In the late 1950's the first CEMA branch commissions were established to coordinate production and research multilaterally by branch of the economy. At the same time "international economic organizations" to conduct joint research in separate fields began to be organized. During the 1960's coordination was extended to the entire gamut of scientific and technical activity of the individual CEMA members. An overall scientific and technical coordinating body was set up, and consolidated five-year plans combining the major cooperative projects of the bloc were instituted.

The 1970's were marked by an ambitious effort to merge the RDI cooperation plans and the overall economic plans of CEMA into a coherent system and to concentrate resources on the priority measures of the new system. At the same time, forecasting and long-range planning of science and technology were introduced as a basis for preparing the five-year plans. In addition, the infrastructure for scientific and technical collaboration was greatly enlarged. The number of international organizations engaged in joint research increased by nearly ten times. A comprehensive support structure for collaboration was built up, including a scientific and technical information exchange system and a machinery for unifying standardization and patent policies.

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*CEMA is commonly referred to as CMEA, The Council for Mutual Economic Assistance. It is also known as Comecon.

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The cooperation of the CEMA countries in promoting science and technology has had a number of positive effects on the industrial growth and technological level of the bloc as a whole. Furthermore, linking the capacities and resources of the CEMA members to the Soviet economy has increased the science and technology potential of the Soviet Union by approximately a quarter. Nevertheless, CEMA scientific and technical integration suffers from shortcomings that are reflective of economic management within the separate countries and that prevent the community from consolidating its potential into a truly working whole. These shortcomings include poor and incomplete linkage of cooperation in science and technology and overall economic cooperation, failure to apply many of the results of cooperation in the national economies, sacrifice of bloc agreements in the carrying out of collaborative projects to the demands of national sovereignty, lack of uniformity in calculating and evaluating the effects of joint scientific undertakings, and weakness of national incentives to engage in collective projects and adopt their results, as against going it alone or importing technology from the West.

I. INTRODUCTION

The Council for Economic Mutual Assistance (CEMA) was founded in January 1949 to promote economic cooperation and trade among the U.S.S.R. and the Communist states closely allied with it and to consolidate the resources of the Communist bloc as a counterbalance to the economic power and attraction of the West. The members of CEMA today are Bulgaria, Cuba, Czechoslovakia, East Germany, Hungary, Mongolia, Poland, Romania, the U.S.S.R., and Vietnam. During the 33-year history of CEMA, the member countries have built up an extensive panoply of organizations and contacts for economic cooperation, including cooperation in scientific research and development and technological innovation (referred to in this article as RDI—research, development, and innovation).

RDI collaboration has become more important to CEMA leaders and administrators during the past decade because of the increasing importance attached to the "scientific and technical revolution," that is, the rapidly growing interaction between new technology and desired improvement in production capacity and performance. In 1980, over 3,000 scientific and engineering institutes and organizations (NO's)[1] in the CEMA countries were engaged in about 4,000 RDI projects coordinated in national plans, carried out under common direction, or performed jointly in international organizations of CEMA countries. The CEMA community expected an estimated economic return of 9 to 11 billion rubles in 1980 from increases in production and productivity resulting from these projects.[2] The 3,000 NO's involved are nearly one-fourth of all NO's in

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[1] NO is the standard Russian acronym for *nauchnaya organizatsiya*—scientific organization. In Soviet and CEMA terminology, an NO designates an independent (not incorporated in a production enterprise) organization doing R&D, designing and testing new equipment and processes, installing and adapting developed new technology, or providing technical services for RDI organizations.

[2] Vlaskin, "Mechanism," 1980, p. 50, and Gutiyeva, "Cooperation," 1978, p. 195. About 1,600 of the 3,000 NO's were involved in multilateral projects and the remainder in bilateral undertak-

Continued

the CEMA countries.[3] They include many of the largest and most prestigious institutes so that their share of total CEMA RDI potential is likely to be even greater than their number indicates. Although the 3,000 NO's do not work exclusively on CEMA projects, the choice and direction of national projects is undoubtedly influenced by the projects undertaken with or by other CEMA countries.

CEMA's RDI integration policy has changed steadily in accordance with the growing importance and scope of cooperation. Although the evolution of the policy did not follow a master plan of carefully orchestrated stages, there has been a definite progression from rudimentary contacts and incidental information exchanges in science and technology to a set of elaborate multilateral and bilateral RDI plans. These plans are tied to national plans and administered by a complex and comprehensive network of intercountry organizations closely linked to appropriate administrative agencies in the individual countries. However, no attempt has yet been made to combine the national RDI plans of the CEMA countries into a single plan limiting each country to work in given areas and stages, and no such combination is contemplated. As one writer noted, the conditions do not exist for such a drastic policy in "the current stage of socialism." [4] The CEMA-wide RDI plans incorporate only projects on which the individual countries have agreed to cooperate or coordinate their efforts. Hence, the integration of science and technology in CEMA at present is more than just an international sharing of national RDI results and less than a merger of national RDI into a unified international endeavor. It is, however, in the process of moving toward the latter pole.

CEMA RDI collaboration is promoted and implemented by an intricate and comprehensive administration. Collaboration extends beyond the mere conduct of common RDI projects to encompass the infrastructure and support systems for RDI. The CEMA organizations responsible for planning and conducting RDI collaboration include: (1) the top decision-making organs, which formulate all CEMA policies; (2) CEMA committees that plan and supervise overall RDI collaboration; (3) branch commissions, which are responsible for RDI cooperation in economic branches; (4) intergovernmental commissions that carry out bilateral agreements for cooperation; and (5) international economic organizations, which supervise or conduct specific multilateral projects and services. The RDI support areas in which the CEMA countries collaborate are: (1) forecasting and planning RDI collaboration; (2) funding and checking fulfillment of plans and international contracts; (3) exchanging and joint training of personnel and establishing common training standards; (4) exchanging scientific and technical information and organizing a CEMA scientific and technical information service; (5)

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ings (Petrov, "Raising," 1979, p. 61). The number of RDI projects and the amount of estimated economic return refer only to uncompleted projects in progress. During the period of 1969–1979, the CEMA countries have collaborated on over 14,000 projects, reportedly resulting in 1,700 new machine designs, 1,300 new industrial processes, and 1,400 new products (Petrov, "Raising," 1979, p. 61). Another source claims that the CEMA community saved 31 billion rubles from 1948 to 1975 due to exchanges of RDI information (Gutiyeva, "Cooperation," 1978, p. 202).

[3] Based on the number of NO's for all the Eastern European CEMA countries estimated by Vlaskin, "General," 1977, p. 56.

[4] Stepanenko, *Sovershenstvovaniye*, 1974, p. 95.

providing common and national RDI undertakings with special equipment; (6) unifying CEMA industrial standards; (7) developing common legal inventions procedures and patent regulations; and (8) promoting cooperation and division of labor in fundamental research.

In Section II of this article, the historical development of CEMA RDI integration is traced since its inception in 1949, and an evaluation of the successes and shortcomings of RDI integration is presented in Section III.

II. HISTORICAL DEVELOPMENT OF SCIENTIFIC AND TECHNICAL INTEGRATION IN CEMA

In the years from 1947 to 1955, RDI collaboration in the CEMA countries consisted mainly of technological transfers, most of them from the U.S.S.R. to the other CEMA countries, and bilateral government agreements to effect these transfers. During this period, there was practically no collaboration in the actual conduct of R&D and no coordination of separate country research efforts. The main reason for this lack of collaboration was that each country pursued its own economic development and built up its own network of industries and research institutions with little regard for the role of its economy in a larger context. Moreover, planning of RDI as a systematic field of activity tied to production plans hardly existed within any country, let alone on an international basis. Yet, the limited RDI cooperation that did take place was unprecedented for the formerly autarchic Soviet Union and contributed appreciably to its recovery from World War II and to industrialization in the CEMA bloc.

The Second Session of CEMA representatives held in Sofia, Bulgaria, in August 1949 formalized the bilateral agreement approach by adopting the so-called Sofia Principles, approving the practice of nonremuneration in the exchange of technical documents and licenses to speed up industrialization, and advocating regular exchanges of industrial experts, scientists, and students to render technical aid and deepen scientific knowledge.[5] The major part of the technological flow engendered by the bilateral agreements went from the advanced countries, mainly the U.S.S.R., East Germany, and Czechoslovakia, to the more economically backward CEMA members, since the latter had very little advanced technology to share.[6] The Soviet Union was by far the largest source of technological transfers, giving other Communist countries 3.6 times more technical documents than it received from them during 1948–1961.[7]

The policy of technological exchange practiced before 1956 helped the less-developed Communist countries begin industrialization, promoted the establishment of a somewhat uniform technology within the Communist bloc, prevented some duplication of RDI work, and encouraged specialization in production and research.[8]

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[5] Stepanenko, *Sovershenstvovaniye*, 1974, pp. 74–75, and Kaser, *Comecon*, 1965, p. 42.

[6] Altukhov et al., *Sotrudnichestvo*, 1979, pp. 112, and Miroshnichenko et al., *O kollektivnom*, 1968, p. 250.

[7] Bykov, *Nauchno-*, 1970, pp. 68–69.

[8] Chukanov et al., *Nauchno-*, 1973, p. 60.

Still, it fell far short of establishing a common scientific and technical management and coordinating the development of new technology. The numerous bilateral agreements were limited to specific areas or projects even between the signatories and did not greatly affect the whole spectrum of RDI.

The death of Stalin in 1953 and the consolidation of the more liberal Khrushchev regime in the late 1950's produced a new official outlook on socialist bloc integration. CEMA was regarded more as a commonwealth and less as a cluster of satellites separately controlled by a paternalistic state. An early manifestation of this change was a CEMA resolution in December 1955 to begin work on coordinating the national economic plans of the members of the five-year period of 1956–1960.

During 1956 to 1962, the first steps were taken to move beyond the prevailing bilateral framework of RDI assistance and to coordinate RDI on a CEMA-wide basis, though the multilateral coordination actually carried out was confined to separate branches of the economy. In May 1956, at the Seventh Session of CEMA, eight permanent branch commissions were created to coordinate and oversee the implementation of branch economic goals in the CEMA countries.[9] Among the functions of the commissions were coordination of RDI agreements, exchange of scientific and technical information, and organization of international conferences of scientists and technical experts in different fields of RDI.[10]

This new emphasis on branch multilateral cooperation was also reflected in agreements to conduct joint research in specific fields of science by organizing chartered "international economic organizations" to direct or conduct research in these fields. The first such major multilateral undertaking of CEMA, agreed to in 1955 and launched in March 1956, was the organization of the Joint Institute for Nuclear Research at Dubna in the U.S.S.R.

After organization of the permanent branch commissions and the first international economic organizations, the next logical step in RDI integration perceived by CEMA officials was overall or multibranch coordination. In 1962, the 16th CEMA Session established the CEMA Permanent Commission for the Coordination of Scientific and Technical Research to serve as a general contact agency for the CEMA scientific and technical community by organizing conferences of scientists and planning officials, coordinating the work of the branch commissions, and drafting the first CEMA-wide RDI plans.

During the years 1963–1970, the CEMA countries adopted the first CEMA-wide plans combining the major multilateral and bilateral RDI projects of the bloc. Since the CEMA countries of Eastern Europe were trying for the first time to integrate RDI planning on the national level, both by linking the stages of RDI and by tying RDI plans to general production and investment plans, it was felt that RDI integration could be gradually extended to the CEMA level as well.[11]

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[9] The commissions were for agriculture, electric power, coal, oil and gas, ferrous metallurgy, nonferrous metallurgy, chemicals, and machine-building. Commissions for construction and transportation were established in June 1958 and the Commission for the Use of Atomic Energy for Peaceful Purposes in June 1960. Commissions for the radio-technical and electronics industry, geology, light industry, and food industry were organized in July 1963 and one for communications in July 1971.

[10] Stepanenko, *Sovershenstvovaniye,* 1974, pp. 75–77; Bykov, "The Soviet," 1973, pp. 10–12; and Chukanov et al., *Nauchno–,* 1975, p. 64.

In February 1964, the CEMA Executive Committee approved the first "consolidated," CEMA-wide RDI plan, drawn up by the Permanent Commission for Coordination of Scientific and Technical Research, as a pioneering venture for the years 1964 and 1965. This was followed by the first five-year consolidated RDI plan for the 1966–1970 period. In order to make the consolidated plans more palatable to reluctant governments, they were based on bilateral RDI plans drawn up separately between the U.S.S.R. and the other CEMA countries of Eastern Europe. The first of these was concluded between the U.S.S.R. and Czechoslovakia in May 1964 and the remaining plans between the U.S.S.R. and each of the other governments during 1965 and 1966.[12] Thus, the existing bilateral agreements in specific projects were reinforced by bilateral plans coordinating all major joint RDI activity of the signatories.

During 1963–1970, uncompensated technology transfers were partly replaced by sales based on international contracts drawn up by ministries, NO's or enterprises, mainly among the more technologically advanced countries. The practice of making uncompensated transfers was not abandoned, but it was believed that it had served its purpose of rapidly industrializing and raising the technological level of the more backward CEMA countries and that it had become a disincentive to the transmission of new technology and scientific discoveries.[13]

The attempt to coordinate CEMA RDI planning during the 1960's resulted in such a jumble of overlapping plans that CEMA spokesmen increasingly called for more systematic integration. Economic planning itself demanded better international integration because of the rapid economic growth of the CEMA countries during the 1960's, the consequent higher costs of production autonomy and duplication, and the growing constraints on raw material and employment resources.

The first effort to systematize and combine RDI and economic planning was made by adopting the Complex Program to Intensify and Improve Cooperation and Development of Socialist Economic Integration of the CEMA Member Countries, ratified by the 25th CEMA Session in July 1971. The Complex Program was designed to establish basic economic and RDI integration in CEMA over a 15 to 20 year period. The RDI portion of the Complex Program called for a shift from coordinated and joint work on isolated RDI projects to collaboration in 19 comprehensive programs each embracing a number of related projects.[14] The 25th Session also reorganized the Permanent Commission for the Coordination of Scientific and Technical Research as the Committee for Scientific and Technical Cooperation. This change invested the new Committee with greater authority to coordinate the planning of the CEMA branch commissions and international organizations and made it responsible for planning and supervising the RDI measures of the Complex Program.[15]

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[11] Vlaskin, "General," 1977, pp. 49–50; Stepanenko, *Sovershenstvovaniye*, 1974, pp. 77–80; Bykov, "The Soviet," 1973, p. 13; Bykov, *Nauchno-*, 1970, p. 90; and Jordan, "Scientific," 1970, pp. 381–383.

[12] Stepanenko, *Sovershenstvovaniye*, 1974, p. 79; Chukanov et al., *Nauchno-*, 1973, pp. 65, 68–69; and Bykov, *Nauchno-*, 1970, pp. 114–115.

[13] Semonova, *Nauchno-*, 1980, pp. 30–31; Zapletnyuk, *Predpriyatiya*, 1975, p. 52; and Chukanov et al., *Nauchno-*, 1973, pp. 54–55.

[14] Shiryayev, *Sotsialisticheskaya*, 1978, p. 72; Bykov and Lebin, *Nauchno-*, 1974, pp. 141–142; and *Kompleksnaya*, 1971, pp. 7–11.

The system of consolidated five-year RDI plans of the 1960's was continued during the 1970's, but the plans of the 1970's were drafted as integral stages of the Complex Program. They placed a greater emphasis on joint research efforts and were not as confined to meshing of separate country plans and elimination of duplication. The RDI plans were further merged with both current and long-range economic goals by two measures passed by the 29th CEMA Session in June 1975. The first of these was the adoption of a five-year "Concerted Plan of Multilateral Integration Measures," apparently consisting of the more crucial integration goals of the regular CEMA plans for economic and RDI cooperation. The RDI section of the Concerted Plan singled out 17 broad problems and 71 specific projects for cooperative endeavor.[16] The second measure approved by the 29th CEMA Session was the drafting of a perspective economic plan for 10 to 15 years, called the "Long-Term Programs of Goals in Cooperation (*dolgosrochnyye tselevyye programmy sotrudnichestva*—DTsPS)." The DTsPS also contained a section of RDI goals to be attained by 1990 and which were integrated into the regular CEMA five-year and concerted plans.[17]

During the 1970's, there was a sharp growth in the number of CEMA international economic organizations and institutes coordinating or actually conducting joint RDI projects. Although such organizations had been created before the 1970's, nearly 90 percent of those in existence as of 1980 were set up after 1971. The international organizations before 1971 had been limited to a few selected fields, such as nuclear research, bearing technology, mechanization of vegetable and fruit culture, strong magnetic fields and low temperatures, and computer technology. Most of the new organizations were the so-called "coordination centers" responsible for implementing the several scientific programs listed in the Complex Program and comprehending the whole spectrum of CEMA-country science and technology.

III. BENEFITS AND PROBLEMS OF SCIENTIFIC AND TECHNICAL INTEGRATION

Cooperation of the CEMA countries in RDI has yielded favorable results and continues to do so, in spite of the slowdown in Communist economic growth and the disruption of cooperation caused by the Polish crisis. It has sped up scientific discoveries, increased the number of new products and production techniques, and promoted national specialization in RDI and indirectly in industry. Without CEMA support, the economically least advanced countries of the bloc probably would not have been able to contribute much to science and technology because they lacked the resources and specialists to cover all fields of RDI. CEMA enabled them to specialize, each country concentrating on a few key fields and sharing its achievements. A major factor in the industrialization of these countries was technological assistance from the Soviet Union and the other industrialized members. The advanced countries also benefited from the CEMA association by being able to specialize in RDI and industry and receive easy access to the technology and know-how developed in the rest of the CEMA bloc.[18]

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[15] Chukanov et al., *Nauchno-*, 1973, p. 71.

[16] Zaleski and Wiernert, *Technology*, 1980, p. 51; Kirillin, "Role," 1979, p. 31; and Vorov and Rakhutin, "Concerted," 1979, pp. 56–57.

[17] Vlaskin, "Mechanism," 1980, p. 57, and Zaleski and Wiernert, *Technology*, 1980, pp. 51–52.

Although the Soviet Union apparently benefited less from RDI cooperation than the other CEMA countries, particularly before 1970, because it had the capacity to make immense investments and train numerous personnel in the entire range of RDI, it too has received appreciable benefits. Even an economy as large as the Soviet Union's can incur significant extra expense in developing technologies that can be more efficiently left to a small CEMA country. The gains for the U.S.S.R. have been especially marked in such areas as fertilizer production and improvement, mechanization of fruit and vegetable culture, technology of coal mining, robotics, numerical programming control in machine tools, magnetohydrodynamic power, development of anti-corrosion techniques in metallurgy, optical technology, polyethylene production, pharmaceutics, epidemiological control, ergonomics, railroad container technology, and woodworking and furniture technology. The contribution of the other CEMA countries to the acceleration of the U.S.S.R.'s computerization programs has been explicitly acknowledged. Without the contributions of other CEMA countries, the development of the Ryad series of computers, which were intended to make the Soviet bloc independent of imports of computers from the West, might have been long delayed or possible only with substantial technology transfer from the West.[19] In addition, the CEMA connection has made it possible for the Soviet Union to obtain advanced technology acquired by the other CEMA countries from Western countries, although this benefit has not been discussed often or specifically in Soviet and CEMA publications. For example, Michael Checinski, a former counterintelligence officer in the Polish armed forces, cites a case in which the Polish electronics industry during the 1950's purchased telephone exchange equipment from the Swedish electronics firm L. M. Ericsson. Upon the request of the Soviet Government, Poland forwarded the specifications for this equipment to the Soviet Union, which then organized its own production of the telephone exchanges.[20]

Besides increasing the number and quality of technological achievements and improvements introduced in the Soviet economy,

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[18] Kiss, *Problemy*, 1971, p. 108. In 1965, long before the intensification of CEMA integration of the 1970's, Michael Kaser, who generally displayed a skeptical view of the success of CEMA integration, credited the technology exchange policy of the Communist states with being "unquestionably . . . one of Comecon's most successful objectives" (Kaser, *Comecon*, 1965, p. 126). Data on the benefits of RDI cooperation in the individual CEMA countries are only occasionally published and apparently do not rest on any uniform criteria. Polish economists estimated that in the period before 1970, 15 percent of new designs and processes used in Polish industry were the result of CEMA cooperation (Stepanenko, *Sovershenstvovaniye*, 1974, p. 38). In East Germany in the mid-1970's, 80 percent of all projects in the state science and technology plan were claimed to have some input from or to be making some contribution to bilateral and multilateral projects of collaboration with other CEMA countries (Schoenemark in *Die Wirtschaft*, 1975, p. 17).

[19] See Ashastin, "Cooperation," 1980, p. 84; Vorotnikov and Lebin, *Mezhdunarodnyye*, 1980, pp. 84-85; and Goodman, "Soviet," 1979, pp. 554-559.

[20] Checinski, *A Comparison*, 1981, p. 15.

CEMA integration has added substantially to the RDI potential of the U.S.S.R. Various estimates and figures presented in Soviet and CEMA publications indicate that the CEMA members other than the U.S.S.R. account for about 20 to 25 of all CEMA-bloc R&D resources, including investments, equipment, establishments, and employment.[21]

Nevertheless, CEMA RDI integration has not worked out as well as CEMA officials have wished or claimed. The performance has been marred by failures in plan coordination, low incentives, and organizational obstructions that might be expected of the highly bureaucratic CEMA organization maintained by governments equally bureaucratic. Criticisms of the CEMA effort made by Soviet and other CEMA country writers are sparse and far between the reams of praise and formal description in CEMA literature, but they are repeated often enough to demonstrate a number of grave and vexing problems.

The two weakest links in collaboration to advance science and technology are the assimilation of discoveries and new developments in producing finished products and the diffusion of innovations throughout the general economies of the CEMA members. The weakness in these links suggests a careless and rudimentary connection between RDI and production planning.

Indeed, one of the most common complaints about CEMA RDI collaboration, especially prior to 1972, is that it has failed to become an "organic part"of total economic cooperation because the planning of CEMA RDI programs tends to be excessively isolated from economic planning. Every link in the chain of CEMA RDI planning—forecasting, sketching the perspective plans, drafting the five-year plans, and detailing current working plans—apparently is plagued by failure to dovetail RDI and economic projections into a smoothly working, compatible whole. This failure is caused by a number of factors that have been inadequately explored by CEMA economists and administrators. These factors include the inherent difficulty of making goals in such an unpredictable field as RDI match projected economic requirements and aims, the reluctance of many CEMA members to compromise national interests with CEMA aspirations, the absence of efficient RDI-economic coordination in the individual countries with a consequent lack of data to draw up realistic CEMA plans, and the division of administrative responsibility in the CEMA apparatus between RDI and economic planning. RDI programs have often been "pulled out of a hat" as goals in themselves and not firmly linked to production requirements and sales prospects.[22] This is a common complaint about RDI planning in the individual countries as well.

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[21] It is difficult, even for CEMA specialists, to calculate the shares of RDI or R&D capability of the separate CEMA countries because of the incommensurability of national data. The U.S.S.R.'s share has been variously estimated as follows:

Total scientific employment: 84 percent (1980); 80 percent (1977)
Scientific workers: 84 percent (1979); 75 percent (1977); 80 percent (1974)
Science spending: 78 percent (1974)
Annual applications for patents: 80.1 percent (1980)
Total R&D potential: 75 percent (1975)

The estimated shares of the other CEMA countries in various indicators of R&D potential fall in the following ranges:

East Germany, Czechoslovakia, and Poland: 4 to 6 percent each
Hungary, Romania, and Bulgaria: 1.5 to 2.4 percent each
Cuba, Mongolia, and Vietnam: 0.1 percent or less each.

These measures of potential, however, do not necessarily correspond to distributions of achievement or quality (Bykov and Lebin, *Sotsialisticheskaya*, 1981, p. 48; Nayashkov, "Invention," 1980, p. 29; Maslennikov and Andriycshin, "Scientific," 1979, p. 36; Ladygin and Zotova, *Sotsialisticheskaya*, 1977, p. 202; Sydow," 1977, p. 54; Vlaskin, "General," 1977, p. 56; Bykov, *Po puti*, 1975, p. 60; and Bykov, *Nauchno–*, 1974, pp. 29, 48).

Planning the R&D phases of the RDI cycle has been more successsful than innovation planning because of the coordination of research projects of all types by the Committee for Scientific and Technical Cooperation. But applying the results of R&D in the overall CEMA economy has been far less effective because adequate provisions have not been made in RDI and economic plans for introducing the results in appropriate enterprises. Nor has a systematic set of incentives and sanctions been devised by member states to promote diffusion of the results. Although RDI on the branch-of-the-economy level has had some success, interbranch coordination has been especially poor. This has caused duplication of research efforts across several branches and limitation of the results of research to single branches. An additional effect of poor linkage of economic plans has been the pursuit of many joint R&D projects offering little economic return and the neglect of R&D that would accelerate the economic integration goals set for CEMA. These consequences of poor RDI-production coordination are especially frustrating because during the last decade and a half, Communist-bloc economic planners have been shifting their emphasis from quantitative growth to "intensive" development, that is, to greater efficiency in the use of resources, energy, and labor and to faster and fuller application of science.[23]

During the 1970's, in response to these deficiencies, the entire planning mechanism of CEMA was revamped to improve integration of RDI and production. Long-range programs in both RDI and production were combined in the Complex Program of 1971, economic goals were increasingly based on scientific and technical forecasts, funds and efforts were concentrated on the key measures of economic and RDI integration in the Concerted Plans initiated in 1975, and duplication of RDI work in the individual countries was significantly reduced. RDI planning still remains somewhat loose due to incomplete meshing of the overall economic and RDI plans on the one hand and the plans of the separate CEMA branch commissions on the other, but the problem of poor integration is receiving continuing attention.[24] For example, a proposal has been under discussion since the late 1970's to draft a special CEMA plan for using new jointly developed products and processes in specific countries and production sectors.[25] The partial disruption of the Polish economy in 1980 and 1981, caused by labor unrest, can be expected to have a negative effect on CEMA planning coordination. The impact of the Polish crisis on RDI cooperation, however, has not yet been directly treated in CEMA economic analyses and editorials. On the contrary, recent Soviet articles on CEMA foresee the 1980's as a time of even more successful and "intensive cooperation in production, science, and technology."[26] It is perhaps too early to judge the efficacy of the planning reforms of the 1970's or the effects of the Polish crisis on production and RDI plan fulfillment.

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[22] For instance, in Czechoslovakia in 1979 only 8.5 percent of cooperative RDI contracts had any impact on its division of labor in production within CEMA (Bykov and Lebin, *Sotsialisticheskaya*, 1981, p. 175).

[23] See Zubkov et al., *Otraslevaya*, 1976, pp. 150–151.

[24] See Bykov, "Important," 1980, pp. 118–199; Cherkasov and Mel'nikov, "Mechanism," 1979, p. 104; Chukanov, "Scientific," 1977, p. 199; Letenko and Krasotova, "Effectiveness," 1975, pp. 128–129; and Bykov, *Nauchno-*, 1974, pp. 46–47.

[25] Alekhin and Vlaskin, "Cooperation," 1976, p. 157.

Although the integration of RDI and production cooperation was reformed during the 1970's, there are still major difficulties in executing the plans and applying the achievement of RDI cooperation. Perhaps the ultimate constraint on effective integration is that CEMA, as CEMA writers frequently assert, is a voluntary organization based on the principle of national sovereignty and that the official bodies of CEMA are not "supranational" agencies authorized to give orders to member governments. Moreover, there is no prospect that CEMA will be granted such authority.[27] The current limitations on CEMA's authority probably satisfy the nationalistic sentiments of member countries, but they also make it difficult to enforce country obligations consistently and they slow the adoption of uniform laws and standards relating to RDI. "Coordinated" RDI projects, in which the work is subdivided but performed by national NO's on their own, depend essentially on the voluntary compliance of each country for their fulfillment. Individual countries often make inadequate provision in their RDI plans for support of projects, do not bear their share of the financial and manpower loan, and let their work fall behind schedule. Sometimes they even abandon their assignments if they deem the research of little value for their own needs, leaving their partners in the lurch. A Czechoslovak commentator, for instance, noted that in the CEMA computer research program, Czechoslovakia was assigned work on the development of computers that would produce few benefits for the national economy, but nevertheless Czechoslovakia was "complying in a disciplined manner" with the recommendations of CEMA organs.[28] The national "head organizations" directing the projects do not have the legal means to enforce decisions and make changes in plans and therefore must rely solely on the cooperation of the participating NO's and the national ministries. To be sure, the NO's working on coordinated projects are constrained by contractual obligations incurred with NO's of other countries, and economic and political pressures can be applied to bring uncooperative countries into line. Nevertheless, enforcement of plan obligations is weaker in CEMA projects than in purely national RDI activities.[29]

"Cooperative" RDI projects, which are coordinated by CEMA international organizations but carried out by national NO's, and "joint" projects, which are conducted in facilities collectively managed by the participating countries, are subject to greater central CEMA control and pressure than "coordinated" projects. Nevertheless, the application of the results and the sharing of the benefits of all collaborative RDI are unequal and generally poorly coordinated.

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[26] Dudinskiy, "Socialist," 1981, p. 20.

[27] See Cherkasov and Mel'nikov, "Mechanism," 1979, p. 106, and Maksarev, "Significance," 1977, p. 72.

[28] Nerold, "Computer," 1975, p. 12.

[29] Letenko and Krasotova, "Effectiveness," 1975, p. 128; "Organizational," 1975, p. 94; and Korotkov, "Principles," 1973, pp. 37-38.

Failure to provide for extensive utilization of RDI results within a reasonable lead time after completion of research has been called the gravest defect in CEMA RDI projects. This is not surprising, inasmuch as the same failing has been constantly noted in national RDI planning and management and the problem is bound to be worse in intercountry projects. The fault is not always with the CEMA organs; often the national planning agencies neglect the assimilation of the resulting new technology of fail to make sufficient or realistic investments and other provisions for its diffusion. National ministries and enterprises often have no incentive to adopt the new technology. In other cases, information about the new technology may be inadequately circulated by national scientific and technical information services, or the new technology may not be adapted to national conditions, with the result that the national planning agencies have to duplicate or supplement the work completed under CEMA.[30] The U.S.S.R. has recently proposed that a CEMA cordinating body be established in each country to facilitate the introduction of new CEMA technology. These organizations would encourage the adoption of RDI achievements by overseeing the utilization of new discoveries made under the Complex Program, coordinating CEMA RDI activity in general, and organizing loans to industrial enterprises by the CEMA banks, the International Bank for Economic Cooperation, and the International Investment Bank.[31] However, this proposal would endow the coordinating bodies with power to compel the observance of central CEMA decisions, which would greatly curtail the freedom of member countries, and hence, it is not likely to be realized in the foreseeable future.

Selecting the best RDI programs for the CEMA plans is stymied by the absence of a standard methodology for calculating the economic return of proposed projects. There is practically no evaluation on a CEMA-wide basis of the overall impact of RDI programs on society, culture, politics, the environment, and RDI itself. Although methods for standardizing the estimation of the effectiveness of RDI cooperation have been discussed repeatedly within CEMA throughout the 1970's, little has been done aside from some elementary calculations by the CEMA branch commissions of the savings in production costs resulting from the application of proposed innovations. These calculations have not included estimates of the savings resulting from variant approaches or from cooperation in RDI as against the same RDI conducted by separate countries. The individual CEMA countries pursue their own methods of calculating the return on capital investments and new technology stemming from CEMA collaboration, and in their calculations they use different coefficients and get different results. This lack of uniformity contributes to differences in national incentives to engage in joint RDI projects. Besides the failure to standardize coefficients of return, there is little provision for follow-up on the introduction of new CEMA technology in the individual countries and hence scarcely any feedback information that can be used for developing realistic CEMA-wide criteria of effectiveness.[32]

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[30] Bykov, "Important," 1980, pp. 118–119; Il'yin et al., *Effektivnost'*, 1979, p. 74; and Letenko and Krasotova, "Effectiveness," 1975, p. 128.

[31] Dzhavadov and Sementsov, "Cooperation," 1980, p. 21.

There are a number of disincentives that hinder the complete coordination of country efforts and the elimination of duplication. The first of these is the policy of not compensating for many of the transfers of technology between collaborating countries. Although commercial sales replaced noncompensated transfers to some extent in the late 1960's new technology is still provided free, especially to the less developed countries. Free transfers may accelerate technical progress in the backward economies, but in the advanced countries they have dampened the interest of NO's and ministries in becoming involved in CEMA projects. Free transfers of new technology, at least within European CEMA, have become increasingly counterproductive in RDI integration because the economic gaps between backward and advanced CEMA countries are less pronounced now than they were during the 1950's and 1960's.

The heterogeneity of price structures, costs, salaries of RDI personnel, and incentive systems in the various CEMA countries also discourages cooperation in RDI. The use of the transferable ruble in CEMA transactions to develop a common denominator of RDI value is limited because the national currencies are not systematically pegged to the transferable ruble.[33] Values in one country may stimulate a particular innovation, but prices and incentives in other countries may stimulate it to a lesser degree or even discourage it. Therefore, national ministries, enterprises, and NO's are not always motivated to collaborate and specialize within CEMA but prefer to produce their own technology or import it from the West.

A third factor discouraging CEMA RDI ties is that national NO's and their superior ministries do not have full discretion in negotiating with their foreign counterparts over joint RDI work or the purchase and sale of licenses for new technology. Special national organizations attached to central RDI coordinating agencies or to ministries of foreign trade usually act as intermediaries in the negotiations and, in bureaucratic fashion, often lay down unrealistic specifications and schedules for joint R&D projects or exchanges of licenses and prototypes.[34]

A fourth disincentive to collaborate in RDI is the lack of enforceability of CEMA agreements, especially multilateral agreements. The agreements are based on official CEMA RDI plans, but these plans, unlike the national plans, have the force of recommendations rather than laws. Therefore, a country ministry or NO entering a program of RDI cooperation cannot be assured that the obligations of the other parties will be honored or fulfilled on schedule. This situation often leads NO's in CEMA projects to make back-up agreements with NO's in their own country just to be sure that their plans will not be disrupted or prove impossible to fulfill.

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[32] Il'yin et al., *Effektivnost'*, 1979, pp. 180–181; Stepanenko, "Determining," 1979, pp. 93-94, 101; Gutiyeva, "Cooperation," 1978, pp. 204–206; Ladygin and Zotova, *Sotsialisticheskaya*, 1977, p. 202; and Sydow, "Some," 1977, pp. 71-72.

[33] The transferable ruble was introduced in the early 1960's by the CEMA International Bank for Economic Cooperation.

[34] In the Soviet Union, these agencies are the All-Union Association for Foreign Technology (Vneshtekhnika), subordinate to the State Committee for Science and Technology, and the All-Union Export-Import Association for License Trading (Litsenzintorg) of the U.S.S.R. Ministry of Foreign Trade. The former is concerned with arrangements to conduct joint RDI work and exchange scientific and technical information; the latter deals with the sale and purchase of licenses (see Nolting, *The Structure*, 1979, pp. 17–18, 29).

A fifth drawback to international cooperation is that the NO's in the more advanced countries must often bear an undue share of the costs of joint programs because they possess the best facilities. Moreover, all participating NO's are legally entitled, at no additional cost, to make their own use of the research results; hence the NO's of backward countries receive more benefits in proportion to their contribution than do the NO's in the advanced countries. Although this factor has become somewhat less significant in Eastern Europe with the industrialization of the bloc and the dissemination of technology, uneven burdens and rewards dampen enthusiasm for collaboration among the best endowed institutes.[35]

Little coordination exists between RDI collaboration and foreign trade in individual CEMA countries because of a failure to match foreign trade plans with national RDI plan sections on sales and purchases of licenses, and because of the absence of any CEMA organization to coordinate trade in licenses with non-CEMA countries. Consequently, national importing organizations tend to negotiate the importation of licenses or new products and machinery, whether from CEMA or Western countries, without regard to the existence of related technology within CEMA and make no effort to coordinate the utilization of the technology in the entire CEMA community.[36] For example, during the late 1960's, Hungary and Poland separately purchased licenses for similar types of bus motors from two different Western firms instead of joining to purchase and share a single license. Sometimes such duplications result from lack of information, specifically the absence of a clearing organization to inform CEMA members about each other's foreign trade plans and agreements. But even when a CEMA country's plans to buy licenses for new technology are known, other countries may still decide to go their own way, and there are not enough inducements to defer to the common advantage. For instance, again in the late 1960's, Poland proposed to Hungary that the two countries negotiate with the Swedish firm L. M. Ericsson for the joint purchase of a license for a telephone exchange. Hungary turned down the Polish offer, having decided to buy a license from an Austrian firm. Apparently, the countries did not agree as to which license represented the superior technology or for some reason, their national interests conflicted with their interest in advancing the technology of CEMA. This lack of cooperation resulted in the installation of two types of telephone exchanges in Eastern Europe with different technical parameters, service requirements, and types of spare and replacement parts. The divergent actions of the two countries, repeated in many other fields of technology, hindered the development of a unified technology in telephonic communications, not only in Hungary and Poland, but in all of CEMA.[37]

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[35] Sydow, "Some," 1977, p. 72; Letenko and Krasotova, "Effectiveness," 1975, pp. 128-129; Zapletnyuk, *Predpriyatiya*, 1975, p. 109; Stepanenko, "Basic," 1973, pp. 54-55; Shiryayev and Iovchuk, *Proizvodstvennaya*, 1972, pp. 90-91; and Kiss, *Problemy*, 1971, p. 113.

[36] Boychenko, "Scientific," 1981, p. 93.

[37] Vlaskin, "Mechanism," 1980, p. 53, and Kiss, *Problemy*, 1971, p. 110.

In summary, the CEMA countries have established an intricate system of joint planning and organizing nearly every aspect and field of RDI work, and this system has produced impressive results and perhaps even more impressive prospects. Nevertheless, the system suffers from many problems and much remains to be done, both within the separate countries and in the central CEMA structure, before CEMA can boast that it has attained a fully integrated and effective administrative of science and technology.

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